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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE
INSTITUTION OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION

Institution of British Foundrymen.

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An Appeal to British Foundry Owners

Readers of this journal are aware that an International Foundry Congress and Exhibition is to be held in Paris during the second week of next September. It is now authoritatively announced that the Americans will send no less than 50 delegates. They are already getting busy. What are the British foundry owners doing?

At the next meeting of the General Council of the Institution of British Foundrymen it will most probably be decided that the annual Convention will be held at Manchester, under the presidency of Mr. Oliver Stubbs. The appropriateness of the venue is unquestionable, as during Mr. Stubbs' last term of office industrial conditions prevented the holding of the Conference in his home town, and a belated but successful meeting was held in Blackpool. However, it should not be lost sight of that it is largely owing to the initiative of Messrs. Stubbs, Flagg, Estep, Ronceray, Ramas and Leonard that the International Congress is to take place. What steps are the Institution of British Foundrymen taking? At the last General Council meeting, an invitation to hold the Conference in Paris was turned down, as it was felt it would not be sufficiently representative.

The Americans are sending a delegation of 50 foundrymen several thousands of miles, but the expenses of such delegates will be paid by the foundry owners. Are British owners prepared to send their managers, foremen, or skilled men a few hundreds of miles? If it is worth while for the Americans, it is obviously worth while for the British. The answer, that the question can be considered later, is dangerous, because it is only by co-operative efforts that the French foundrymen can make adequate arrangements for their reception. Additionally, a co-operative effort makes for economy, and often comfort.

The French in the annual gatherings make a special feature of works visits, and the neighbourhood of Paris abounds with excellent foundries, automobile, art and jobbing being especially well represented. Again, Paris can be considered as not merely the capital of France, but of Continental Europe, as from there railways radiate to all countries, bringing with them both exhibitors and buyers. It is not a case of one cannot see one's way clear to go, but one cannot afford to stay at home, or at least be represented.

For this particular meeting we make a special appeal to metallurgical professors and teachers on two grounds. First, the Exhibition and Congress is being held in the Ecole des Arts et Métiers, which contains the finest model foundry in Europe; and, secondly, the mixing with practical men for a few days will bring them in very direct association with the industry they have to serve.

Since the Institution has not announced its intention of organising a visit, we feel that the duty devolves upon THE FOUNDRY TRADE JOURNAL.

We suggest that, as the bulk of the foundries are in the provinces, the Southampton-Havre route is preferable, as it eliminates staying a night in London. Providing the franc exchange remains reasonably within its present range, we are of opinion that the cost could be kept within the means of the majority of foundrymen. The scheme we have envisaged is to provide a ticket covering travelling and hotel expenses. The programme in Paris would be arranged in co-operation with the French Foundrymen's Association. To this cost there would have to be added a tourist ticket to London. We shall be pleased to hear from owners and others who are interested, so that it can be ascertained at an early date whether the scheme is worth while our organising or not. Obviously, the sending in of a name does not in any way bind the writer to go forward. In order to facilitate matters, a coupon has been printed at the bottom of page 16, which merely requires filling in. This should reach us before next Thursday.

An objection which has been raised is the language difficulty. We can assure those who have never visited Paris that English is spoken everywhere. In one large establishment employing 4,000 hands, no less than 1,000 speak English. At the Conference, all those who speak English will have a small enamel Union Jack suspended from their badge.

We consider the occasion of sufficient importance to warrant discussions being held in every foundry in Great Britain to consider the best means of assuring the maximum representation from each foundry. Finally, if it is worth the while of America to be so extensively represented, it should need but few words of ours to indicate that it is at least worth the while of all British foundrymen to be placed on our list, so that they may be informed as to its development.

The Manufacture of Locomotive Cylinders Using Super-Heated Steam.*

By A. F. Gibbs, M.I.Brit.F.

For the sake of clearness this Paper has been divided into three parts—moulding, casting, and practical results.

MOULDING.

This class of cylinder is known to railwaymen as the "S69," or 1,500 class. They are the well-known piston-valve type, which have replaced to a very large extent the slide-valve type of cylinder.

Fig. 1.—Lowering the Exhaust Core into Position. Note the Hook Bolt for Securing in the Mould.

The merits of the one or the other will not be discussed, as being irrelevant to the subject from the foundrymen's point of view. The method of moulding adopted is a combination of dry-sand and loam-moulding. For moulding purposes the bottom half of the pattern is placed upon a flat board, the face of the pattern being slightly damp in order that the parting sand will adhere to it. The pattern is then faced up with loam, which consists of a mixture of new and old sand, cow hair, and horse manure, to an average thickness of about 3 in. This is then wire-vented, and covered with a coating of clay wash. The bottom box part or drag is then placed on a board, and rammed up with core sand. After this the board is clamped to the box part, and the whole rolled over by means of the 15-ton circular sling chains.

Special stays, shaped to fit fairly closely to the pattern, are fitted in both the bottom and top parts of the box. The joint is then made, and the

Fig. 3.—Lowering the Lightening Core into Position. Of the 32 Cores used this is the only one requiring Chaplets.

middle part of the pattern placed in position. This is then loamed up, being treated in exactly the same manner as the bottom portion. After another parting joint has been made, the top part of the pattern is added. No useful purpose can be served by describing the operation, as it closely resembles what has already been said. Obviously, the gates of the runner are placed on this pattern, being carefully loamed and rodded. Additionally, one or two hooks or gaggers are necessary in this part, despite the specially-shaped stays, which carry most of the load, but there are several pockets of sand which need additional support, as when the moulds are being transferred to the drying oven considerable jarring often takes place.

After the top is rammed up, the down stick or runner, together with the four riser sticks, are

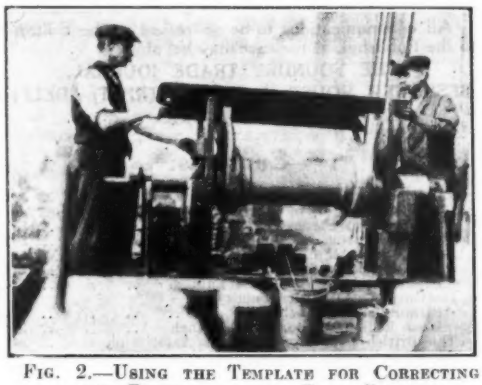


Fig. 2.—Using the Template for Correcting the Position of the Port Cores.

withdrawn. The mould is now taken apart, and the pattern withdrawn, after which the mould is finished in its green state. The moulds are now placed on the trolley ready to enter the drying oven for their first stage of drying, which is carried out at 245 deg. C. for 18 hours. This done, the mould is removed from the oven and a coating of plumbago wash applied. It is then re-stoved for a further 18 hours. The next morning the mould is finally withdrawn from the stove, and is cored up. It will be noticed from the illustration that the exhaust core is provided with a hook bolt for attaching it and preserving its position. This is really more than an exhaust core, as the designer has co-operated with the pattern shop and foundry foreman, and it contains four prints for the piston-valve body-core. It additionally forms part of this body core. The illustration (Fig. 1) only shows half the core, the top half being made in two pieces.

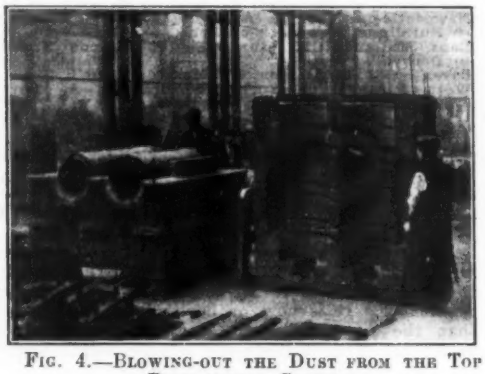


Fig. 4.—Blowing-out the Dust from the Top Part before Closing.

The piston-valve body-core, with the port cores attached, are the next to be placed in position. The illustration (Fig. 2) shows the template board and duplicate prints. The main barrel or body cores, shown in Fig. 3, are in course of construction. The core iron attached to the end of the barrel by means of wedges should be noted. Lightening cores are used to ensure the production of walls of equal thickness. It is the only core out of a total of 32 which necessitates the use of chaplets to preserve its position, this being the last core to enter the mould, which is now re-stoved

* Paper read before the London Branch of the Institution of British Foundrymen.

for the night. The following morning the moulds are brought out and made ready for casting.

It is essential that the four cylinder-cock cores are securely fixed in position. The moulds being closed, a joint is loamed up by a labourer, after which he fastens the three parts together by means of a number of $\frac{5}{8}$-in. bolts. The completed mould is now lowered into the casting pit, where the riser cups are made up, and the runner box placed in position. This runner box measures 4 ft. 6 in. × 20 in. wide × 20 in. deep. Its approximate size when loamed up is 50 in. × 18 in. × 15 in., and it has a capacity of 30 cwts. It may seem that this runner box is too large, and altogether too pretentious, but experience at the Stratford works has shown that it is a paying proposition for any work which must be clean to give just as much attention to the runner as to the moulding itself. Therefore this runner box is lined with loam, dried in the stove, and then black-washed.

CASTING.

It is the practice at the Stratford works to run about three tons of hard iron through the cupola before taking the cylinder iron. Some six sieves of coke are placed on top of this three tons to effect a complete, or at least a partial, separation of the two classes of iron. The cylinder iron is now charged in the cupola, which has a capacity of five tons per hour. Usually it is made up into 8-cwt. charges, with two sieves of coke between each charge. The actual method is 4 cwts. of pig-iron, 4 cwts. scrap, followed by the coke and chalk. After the eight charges, three to four sieves of coke are added to check the on-coming different metal mixtures. The pressure gauge on the blast usually indicates 1 lb. per sq. in. Blast is furnished by four motor-driven Roots blowers.

Special attention is always devoted to the upkeep of ladles, which, if at all dirty, are invariably relined. It requires about three tons of metal to cast these cylinders, the amount being measured to within a $\frac{1}{4}$ cwt. by means of a gauge. In one case, with the Chatelier pyrometer, it was found the end of the pyrometer fused. A Fery radiation pyrometer has also been used to ascertain the temperature, but there is some difficulty in obtaining a true reading.

After leaving the furnace the slag is skimmed from the top of the metal. When approximately the correct pouring temperature is reached, the casting is teemed. For the actual pouring, the runner box is filled with 30 cwts. of metal, the plug withdrawn, and the runner box kept quite full until all the metal has left the ladle. Usually there remains about 2 to 3 in. of metal in the runner box itself, but this metal is taken out as soon as possible, care being taken not to do this too early, otherwise internal pressure in the moulding may cause the casting to drain slightly from the mould, resulting in a waster. The actual time taken in pouring a mould of this character is just over two minutes from the time that the plug is withdrawn.

PRACTICAL RESULTS.

The cylinder mixture used is made from 25 per cent. of Warner's cold blast, 25 per cent. hematite, and 50 per cent. scrap. Tests show it to withstant 14.1 tons per sq. in. tensile, and when bend tested between 12 in. centres gave 1.30 tons. Between 36 in. centres, 1.8 was registered, and with this there was associated a $\frac{3}{4}$-in. deflection. The analysis was returned as:—Gr.=3.8 per cent.; C.c.=0.71 per cent.; Si.=1.61 per cent.; S.=0.16 per cent.; P.=1.0 per cent., and Mn.=0.32 per cent. However, since the lecture the author submits the following as being more representative:—Gr.=2.57 per cent.; C.c.=0.61 per cent.; Si.=2.02 per cent.; P.=0.77 per cent.; Mn.=0.50 per cent., and S.=0.125 per cent.

The average mileage accomplished to date by the cylinders described is 260,000.

Conclusion.

It is not claimed that the latest and most up-to-date method of manufacture of cylinders has been set out, but when it is taken into consideration that, though these cylinders have been manufactured at Stratford since 1912, not one waster has been produced right up to the writing of this Paper, and during this period 145 have been made. With four other classes of cylinders something at less than 1 per cent. of wasters is made, the average output being 132 per annum.

DISCUSSION.

The Branch-President, in opening the discussion, first congratulated Mr. Gibbs upon his lecture. In the course of his remarks, Mr. Gibbs had mentioned that unless they had a proper floor and proper carriages they would get considerable vibration. The time had come when the Institution of British Foundrymen, with their Charter behind them, should be able to raise the status of the foundryman, so that, instead of being the Cinderella of the engineering world, the foundry should be one of the principal shops; they should be in a position to expect proper carriages and a proper floor. He had been struck by the remark made by the lecturer that the moulds were stoved for two periods of 18 hours, for a casting weighing 3 tons. He asked Mr. Gibbs whether his stoves were properly ventilated, because he had seen a considerable number of stoves in which the atmosphere had been churned round and round, and there was no direct means of getting the moisture out of them. He would hardly have thought, with efficient stoves, that it would be necessary to stove a mould for a 3-ton casting for so long a period. He was pleased to notice that Mr. Gibbs had a casting-box, because he believed that a casting-box was the proper thing. Another thing that pleased him was that the G.E.R. works at Stratford were sufficiently up-to-date to use a pyrometer. With regard to the end burning off, he suggested the use of a fire-end of graphite. With a Féry pyrometer, he did not think they could expect to get accurate temperature readings when dealing with cast iron. He had been struck with the analysis of the metal: 1 per cent. of phosphorus appeared to him to be rather high, but how could they quarrel with the composition when they saw the results in mileage of engines fitted with these cylinders? Cylinders made in 1912 and 1913 were not yet worn out, and Mr. Gibbs expected them to last another 12 years. When they obtained a mileage of anything in the neighbourhood of 260,000 he did not think they could adversely criticise the metal, bearing also in mind that the output of cylinders was given by Mr. Gibbs as 132 per annum, 99 per cent. being good castings. He had examined quite a number of cylinder castings during the last 10 years, and was under the impression that steel castings had come somewhat into vogue, particularly for superheat steam locomotives.

Steel Loco-Cylinders.

He was rather surprised to learn that the G.E.R. still continued to use cast-iron for all their cylinders. A number of the steel cylinders which he had examined contained small blow-holes; it was quite likely that such blow-holes as he had seen were in positions which mattered little, but no trouble was taken even to stop with "filling." However, if a cast-iron casting would stand up to superheat temperatures, which nowadays ran up to 340 deg. C., then, having regard to the difficulties encountered in casting these complicated cylinder castings in steel, he could see no reason why cast-iron should be given the go-by, and steel introduced. Perhaps Mr. Gibbs would say whether he had any knowledge of the advantages to be gained by using steel for cylinders, as compared with cast-iron? The paper was short and crisp, and he hoped members would discuss it whole-heartedly.

Pouring Considerations.

Mr. J. Ellis expressed his gratitude to Mr. Gibbs for having come forward and described his methods, and thus exposed himself to criticism. He asked Mr. Gibbs if he would tell him the position of the test-bars on the cylinder. He had noticed that the cylinders were run from the top, and evidently very good results were obtained thereby, but there were many men who had pet ideas as to how to run a cylinder. Some poured from the bottom, and made quite a good job. He instanced a case in which a man in his foundry made a cylinder weighing about 6 tons, and poured it from the top, obtaining quite a good casting. Some 18 months later another man came into the foundry and ran a similar casting from the bottom, which also turned out quite good. Both men were excellent workmen. With regard to the gauging of the cores, the method described did not seem to be up-to-date. The old-fashioned

XUM

way of using blocks of wood was very risky, because the blocks might move. He had seen a frame or cradle used by means of which all the cores could be set out and gauged absolutely correctly. He liked the idea of the very strong moulding boxes, which was undoubtedly good. The mixture of metal seemed to him to be rather high in pig-iron, namely, 50 per cent. He had not the least doubt that many of them had made cylinders with a mixture containing less pig-iron, provided, of course, that the scrap was selected. One might almost say that in some cases they could make cylinders with scrap only, but they must know the nature of the scrap. He did not know whether Mr. Gibbs had noticed any defects arising in the cylinders after having been in use for some years. He mentioned that because, on one occasion, when he had bought some scrap, there was a cylinder weighing about 5 tons. It was a reciprocating engine cylinder for a marine engine, and had been cast crown upwards, and when breaking it up he had discovered that there was a hole about 1 in. wide running over one-third of the area of the crown. The metal was aout 1¼ in. thick, and the hole had been filled up with lead, and yet the cylinder had been at work for 20 years. He was able to trace the makers, and was able to find some of the moulders who knew all about it. That reflected upon foundrymen, because if the inspectors, when inspecting a cylinder, saw a little pin-hole in it, they would sometimes condemn it. He remembered a case in which a Government inspector had inspected a casting weighing about 15 tons. They had not yet got over the difficulty of a crease in a loam mould. Sometimes there was a little crack in the mould, which was filled in by the moulder, and when casting the air got into that crack and pushed the filling out, leaving a little indentation in the casting. He had seen the inspector write "condemned" across the casting because of that. It had taken him (Mr. Ellis) three weeks to get that casting passed, and a Committee from the Admiralty, as well as experts from various shipbuilders, had examined it. Therefore, the products of the foundry had to face very severe inspection.

Teemings Speeds.

Mr. C. A. Otto felt that Mr. Gibbs had left out quite as much as he had given in his haste to get the Paper finished in time to allow of a good discussion. That was quite unnecessary, and Mr. Gibbs might have carried on a little longer. He would like to know whether the job was cast quickly or slowly, because with a head of metal such as the receiver contained, about 25 or 30 cwts., if that were kept full, and the metal fed the mould slowly, it would result in a different casting from that which would be obtained by pouring more quickly. Though the size of the down-runner had been given, the area of the runners supplying metal to the mould must also be considered. Mr. Gibbs had referred to steel in connection with these castings. High-pressure turbines were made in steel, and this was most intricate work, equally as intricate as the cylinder described. He thought that the experience gained in this country during recent years in connection with steel would be of advantage in turning out castings of equal intricacy as those under discussion.

Analysis Queried.

Mr. A. R. Bartlett expressed surprise at the analysis of the metal used, especially so far as the silicon and phosphorus content was concerned; they were both rather high. He assumed that in superheated steam work the silicon would be rather on the high side. He would like to know the number of the pig-irons used and also where the phosphorus came from. The description showed that there were core carriages on a sand floor, which seemed to be rather unwise, and hooks, etc., had been put in the cores to withstand the jar. It would be a wise policy to get that altered and so avoid that trouble. There was one point in connection with the moulding box, and that was the position of the trunnions. It seemed to him that the thing was being turned on the trunnion in the wrong direction. If that trunnion were on the opposite way, it would be turning on the bridge of the mould instead of turning crossway on with the possibility of a fall-out. He would also like to know the dimensions of the runners. As to running, he agreed with Mr. Gibbs' practice of running from the top. He believed that was right, especially if the runners were not too large, because he would get the best metal at the top. He believed, in connection with running cylinders, that as a general rule—although every one was dealt with on its merits—it was best to run from the top, because then the best metal was at the top of the casting, where otherwise when running from the bottom they were pushing up the dull metal, and that had a tendency to catch underneath the cores. Unless the casting were of extraordinary depth, it was wise to run from the top. He would also like to know if Mr. Gibbs could say the number of ounces of blast that he used.

Runner Cups.

Mr. H. O. Slater, referring to the mixture, asked if the lecturer melted the iron once, poured it, and then re-melted again for the actual casting. With regard to runner cups, he believed that the small runner cup sometimes was responsible for a large amount of dirt in the cylinder. He was pleased to see the method adopted by the lecturer in keeping the runner box filled during pouring. He also agreed with the system of leaving a certain amount of metal in the bottom of the runner box after the casting was made, in order to avoid porosity, caused by the expansion of the core irons and cores, and so on, pushing the metal out. He had noticed that there was a fairly large air outlet from the core, and he asked the lecturer if, from his experience, this had caused porosity through the hot air coming in contact with the atmosphere or by the metal getting into the barrel.

Mr. J. D. Hotchkiss, dealing with the merits of cast iron as against steel for cylinders, said that cast iron had self-lubricating properties, and he did not know whether that had anything to do with the difference between the two metals.

Mr. G. C. Pierce said he spoke with some diffidence, because Mr. Gibb had said that his works turned out 132 cylinders per annum, and seldom saw a waster, and he felt that he was treading upon rather delicate ground. At the same time, he would like to know why the moulds were faced with loam. He had seen a great deal of cylinders cast in a similar manner to those at the G.E.R. works, but the cylinders took longer to make in that manner than in the ordinary good dry-sand manner. There was a lot to be said for loam casting, but on this particular job he was of the opinion that much time could be saved by using dry sand.

Separating Charges.

Mr. V. C. Faulkner said, with regard to the practice of putting layers between the metal in the cupola, Dr. Moldenke, at the last meeting of the American foundrymen, had pointed out that this method of putting in layers was no use at all. He had shown from experiments that with nickel chrome pig-iron he could not separate the charges in the cupola. Yet the lecturer pointed out it was his experience that this could be done. With regard to the analysis of the metal, some metallurgists had stated that the manganese should be four times the sulphur, and that they could put in as much sulphur as they liked, provided it had manganese in it. Mr. Young maintains that cast iron is a very difficult thing to analyse; these cylinders were giving good results, and he doubted whether the manganese was not a bit higher and the sulphur a bit lower. Having had some experience of the Féry pyrometer, he believed, from the technical point of view, that this gave bad results, because they always had a cloud of smoke in front of liquid metal.

Chemical Composition.

Mr. A. Whiting, referring to the analysis of the metal, said he believed that, generally, Warner's and hematite contained about 0.05 phosphorus, and yet the mixture contained 1 per cent. phosphorus. As the Warner's and the hematite constituted 50 per cent. of the mixture, the scrap must have contained nearly 2 per cent. phosphorus. He would like to know what scrap was used, and what was its phosphorus content, because he could

not quite see how Mr. Gibb could get a mixture containing 1 per cent. phosphorus, having regard to the low phosphorus content of the Warner's and hematite. Also, with regard to the poring temperature, by the time the metal was taken from the furnace in the ladle, and skimmed off, the temperature must drop before the actual casting took place. He had found from experience that cylinders should be cast with the metal as hot as possible.

Steel *v.* Cast-Iron Cylinders.

The Branch President spoke with regard to the merits of cast iron and steel for cylinders, and a remark which had been made that cast iron was a more or less self-lubricating metal. One of the greatest difficulties to be faced was the efficient lubrication of these cylinders under super-heat conditions. Graphite, in some form or other, was sometimes used in order to get over the trouble, but at the temperature of super-heated steam, even with forced lubrication, it was certainly difficult to get efficient lubrication. In steel cylinders, steel pistons with bronze rims were being used, in order to have the bronze working on the steel, rather than having steel working on steel. These bronze rims had proved successful, and it was possible that they might be made even more so in the near future. They would all understand that if they were putting a bronze rim on a steel piston, it was preferable that the bronze rim should wear rather than the cylinder, because the cylinder casting was very much more expensive to replace than a new bronze rim on the piston. With regard to the pouring temperature of the metal, 1,250 deg. C., several remarks had been made with regard to the fall of temperature during the tapping, the skimming of the metal, etc., before the actual pouring. As a matter of fact, what they were really talking about was the life of the metal; they did not lose very much in actual temperature.

Mr. H. O. Slater asked if the remark applied to iron or non-ferrous metal.

The Branch President said it did not matter what the metal was, the fall of temperature was dependent upon radiation and conduction losses. The losses when using a heated loam-lined ladle were comparatively small unless the ladle was standing in a strong draught of cold air. He recognised that there was such a thing as "life" in cast iron, and it was not so much a matter of fall in actual temperature as the condition in which the metal was when about to be poured.

Mr. Faulkner asked the Branch President how he reconciled his statement with the views of Elliott, who was of opinion that the temperature dropped considerably.

The Branch President asked what was the bulk of the metal.

Mr. Faulkner replied that that was not stated.

The Branch President pointed out that the bulk was of considerable importance.

THE AUTHOR'S REPLY.

Mr. Gibbs, in reply to the discussion, dealt first with the Branch President's remarks as to pouring temperature, and the questions which had been put with regard to the temperature drop. He backed up the Branch President's statement that the temperature did not drop quickly, for often, after the ladle had been away from the furnace, and the metal had been skimmed, the cylinder ganger had had to agitate the metal for quite ten minutes in order to help it to cool down. With regard to the casting of test-bars, those for tensile were cast in the upright position, and the long ones in the flat position. At the same time, they were not cast on the cylinder. The method was to cast them in separate boxes, and they got a shank of metal out of the cylinder ladle after the ladle was full, but he would not say that that was up-to-date practice. With regard to the heating of the stoves, mentioned by the Branch President, he admitted that there was a failing there. As a matter of fact, the stoves at Stratford were heated by hot air; they were not in direct contact with the fire itself, but the air came through the flues. They had certainly not an air inlet circulating the hot air around, and that probably accounted for the somewhat prolonged drying they had to give the moulds. At the same time, they had to bear in mind that the moulds were faced with loam instead of sand, about 3 in. thick, and they therefore required more drying. It might be thought that that was unnecessary; Mr. Pierce had suggested that it would be quicker to face them up with sand instead. Whilst admitting that the Great Eastern Railway cylinders probably took longer to make, he pointed out that the percentage of good castings was very high. He was quite willing to admit the possibility of saving time, but, on the other hand, when they had such a large percentage of good castings they were very chary of making a change. With regard to the phosphorus content of the mixture, he admitted that there was a low percentage of phosphorus in the Warner's and in the hematite. As to the number of Warner's and of the hematite, it was supposed to be No. 1 in each case, but he could not be too sure about it. A question had been asked as to whether the metal was re-melted first. The pig-iron had not been re-melted. The usual practice was to run about 10 cwt. of scrap down the pig bed on the evening before casting, in order to cleanse it. That was the only re-melting that was done, and they picked up considerable dirt from the pig bed in that way. He did not know whether or not it was beneficial to re-melt. They had cast plenty of cylinders without any re-melted scrap at all, and they had been just as good as the others. With regard to the phosphorus content of the scrap, he would say that it was fairly high; the Staveley pig No. 3 was fairly high in phosphorus (1.38 per cent.). He had photo-micrographs of all the pigs used in the foundry, and had confirmed this. He was sorry that he had not another analysis taken to back up the one he had given. As to the sulphur and manganese content, mentioned by Mr. Faulkner, he had had no experience with regard to the manganese content being twice as large or four times as large as the sulphur content. Possibly it would be beneficial, because, from his own experience of metallurgy, if he had a metal high in sulphur, he liked to have a high manganese content also. They would then remove some of the sulphur as manganese sulphide in the slag. Dealing with Mr. Faulkner's remarks about Dr. Moldenke, with regard to the separation of charges in the cupola, Mr. Gibbs said he had a great regard for Dr. Moldenke, but if the members had read what Dr. Moldenke had written on a furnace charged by means of an elevator, they would have found that he had said quite the opposite to what Mr. Faulkner had quoted. He did not agree with what Dr. Moldenke had stated with regard to the separation of charges. His own practical experience had told him that he could separate the charges. For instance, at Stratford they invariably started with hard iron, then wheel iron, cylinder iron, and then ordinary mixture. They had a wheel weighing 16 cwt.; they put one ton on for that, and he would not care to think that he had missed the biggest part of the wheel iron. The fact remained that the iron was in the furnace, and it came down into the melting zones. It was melted, and it went to the well of the furnace. He contended that if they were tapping close, as the metal melted they would receive the amount of charge put in, if weighed in carefully. They had to watch that they tapped low down, and know what they got out as well as what they put in. He did, to a large extent, believe in the separation of charges. If it were proved conclusively to him that the charges could not be separated in the cupola, he would have to go back and say that they had better have all ordinary iron in the foundry. As to the stove carriages and floor, he was sorry that Mr. Bartlett had noticed that the stove carriages were antique. They were hoping to get the foundry more up to date in the near future, and radical alterations were being made. As to the trunnions, he could hardly follow that the position of these were incorrect. The mould was certainly turned up on the trunnions, with the opening of the body core downwards, and as to the jar of the mould when turning on the trunnions, there was practically no jar; the mould went over fairly steadily. If there had been jarring out, it was when the stays of the box were rusting out, and they had then put new ones in. Otherwise, he did not think the trunnions in the box were wrong. In regard to the area of the runners, running at the top, and the dull metal getting under the cores when running from the bottom, he agreed with all that Mr.

Bartlett had said. He had had similar experience. Coming to the area of the inlets, he admitted that the area of the inlets was much greater than the downright, and the downright was 2½ in. diameter. To be logical, they should have the area of the inlet a little smaller than the area of the downright, but the system they were using was introduced long ago, and everything was going all right. Therefore, why change it?

Mr. Slater suggested that that was compensated by the size of the runner cup.

Castings Made Without Feeding Heads.

Mr. Gibbs said that once the plug was withdrawn, and the pouring of the metal actually commenced, the metal finished sinking down in less than two minutes. He had not adopted M. Ronceray's method of slow pouring, yet, so far as cylinders were concerned, but at his works they had poured one or two castings in this way quite satisfactorily. The Branch President had referred to the tapping of one ton only. First of all, the furnaceman started off with a little more than one ton, but he tapped the three tons in three taps, and the average was one ton each time. He had never had any experience of casting steel cylinders, and the super-heater header castings he had mentioned, which were made in Belgium before the war, were the only steel castings they had dealt with. They were made during the war, when the best men were not available. But since being made of cast iron in the Stratford foundry every satisfaction had been obtained. It was more difficult to get a sound steel casting than a sound cast-iron one, and he did not know of anything against cast iron, so far as its life was concerned from a cylinder standpoint. In the piston-valve cylinders they had liners, not made of steel, but of cast iron, as were also the piston heads. With regard to the use of wooden template blocks, mentioned by Mr. Ellis, he agreed that the use of these was old-fashioned. But the template was also used inside the mould, but the preliminary fitting only was done outside the mould. The core was not loamed up until it had been tried in the mould. With regard to defects in cylinders, he could not quote any, except that they had had the super-heater cylinders returned with cracks in the flanges. It had practically been admitted by the drawing office, however, that this was a slight fault in the design. The flanges were not strong enough, and the cracks started from the holes where the cylinders were suspended from the frames. The flanges had therefore been enlarged, and since then—two years ago—they had had no cylinders returned, so that apparently the trouble had been cured.

Mr. Gibbs said the barrel for the core of the bore was left open. He had found no defects owing to the ignition of gases. The barrel was made very firm. They might possibly get that defect with a flimsy barrel, but with a stout barrel there was no defect of that sort.

Vote of Thanks.

Mr. A. R. Bartlett proposed a very hearty vote of thanks to Mr. Gibbs for his Paper. It was very clear and explicit from the foundry point of view, and they must compliment him on the very successful results of his work. He was of opinion that the very successful castings obtained were due to the fact that there must be some very good cupola practice which Mr. Gibbs had not given. Speaking of cupola practice, it seemed very strange that at Stratford they only tapped one ton, and then had to bod in. Why not tap three tons? He had seen fifteen tons tapped without bodding. He suggested that the tapping hole was out of proportion to the metal, and if Mr. Gibbs had the hole a shade smaller, it would be better.

Mr. F. J. Wares seconded the vote of thanks, which was accorded with acclamation.

Mr. Gibbs, in expressing his thanks, said the reading of his Paper had given him very great pleasure. Answering Mr. Bartlett's last question, he said that the well of the furnace only held one ton, perhaps slightly more at times. With regard to the tapping hole being too big, he pointed out that sometimes it was too small.

The F. S. Pearson Engineering Corporation, Fisk Building, New York, have now re-established a department for industrial management and technical auditing of industries and public utilities.

The Preservation of Iron and Steel.

In his Presidential Address to the Oil and Colour Chemists' Association, on October 12, Dr. J. Newton Friend dealt mainly with experiments he had carried out in regard to the preservation of iron and steel from rust and corrosion. As illustrating the importance of the subject, he referred to the estimate made by Sir Robert Hadfield that 28,000,000 tons of steel were lost annually by corrosion, and said that, if we took an average of £20 per ton, the monetary loss amounted to nearly £600,000,000 per annum. Dr. Friend added that he knew a Midland firm which had calculated that the painting of their works worked out at £1 per ton of metal surface painted per year, and the annual cost of painting at, say, £10,000. The painting had to be done every year. Hence the subject of preventing the rusting and corrosion of iron and steel had become one of supreme economic importance.

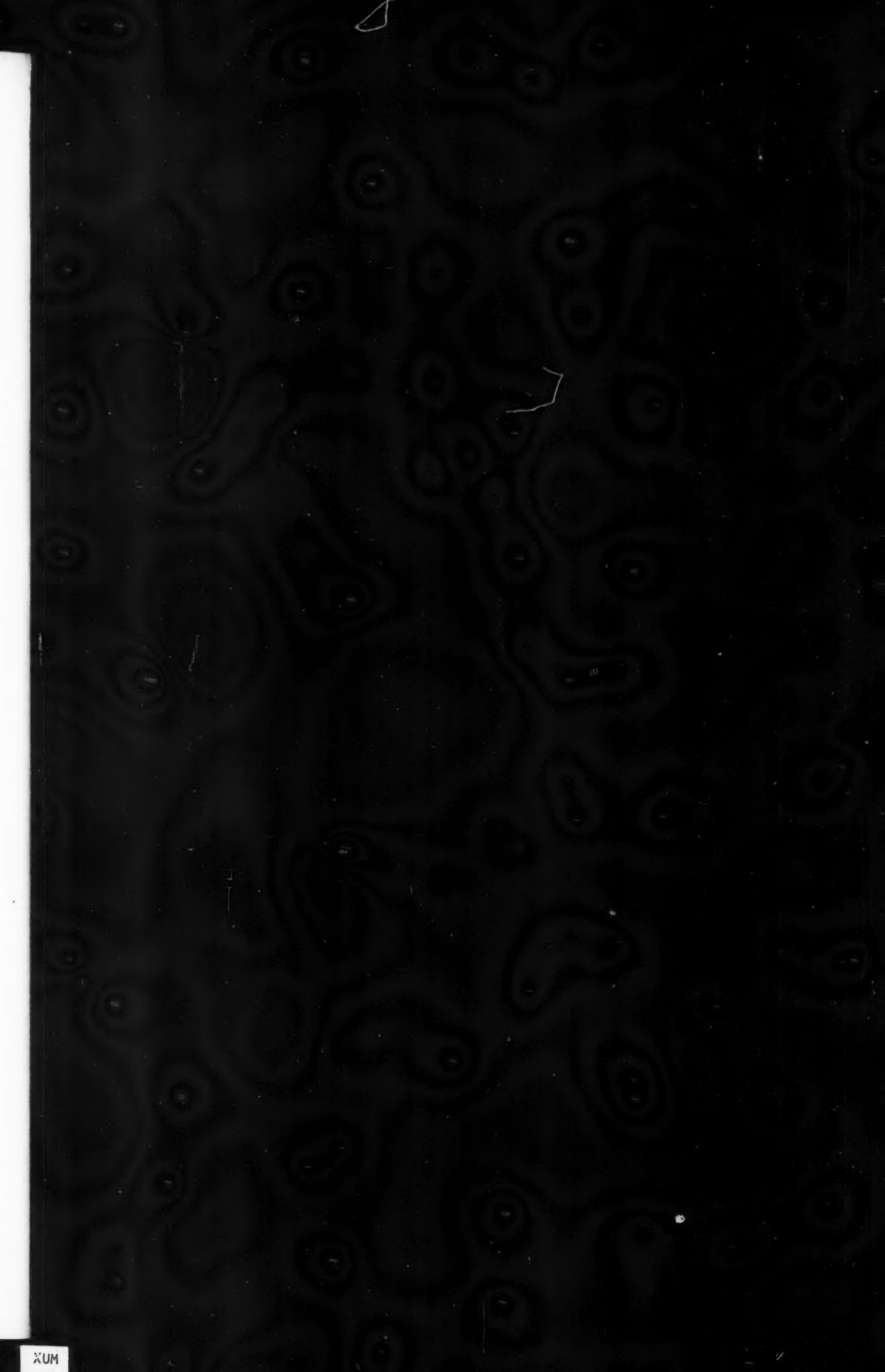
Dr. Friend then dealt with the results of the experiments he had carried out at Birmingham and Worcester, in conjunction with his students and alone. A number of mild steel plates, charcoal annealed, and thoroughly cleaned, were painted with a definite quantity of paint, and were exposed to the air in the form of a fence in the Valley of the Severn. Altogether, the plates were exposed for five years, but they were examined at various periods, and the loss after one month in the case of five precisely similar plates was quite different. In the case of plate No. 1, the loss was 1.55 grammes; plate No. 2, 1.25 grammes; plate No. 3, 1.35 grammes; plate No. 4, 1.60 grammes; and in the case of plate No. 5 the loss was 3.95 grammes. In all sets of plates it was found that there was one which was more erratic in its behaviour than the rest, and this was probably due to some physical or chemical difference.

Discussing the functions of a perfect vehicle for paint, Dr. Friend said it should protect the painted surface, bind the pigmentary particles, and expand and contract with the painted surface. As regards linseed oil as a vehicle, this rapidly absorbed oxygen, giving a clear substance known as linoxyn, the chemical composition of which was still a matter of discussion, but it was this fact which gave linseed oil its good properties over any other vehicle.

Passing on to the perfect pigment, the functions of this were:—Mechanical support to linoxyn, reduction of paint permeability, increase of viscosity, and reduction of the amount of expansion on setting. A greater degree of perfection had been reached in pigment than in oil. Experiments had been made with red, black, and white pigments, and it had been found that in the dark all three behaved similarly, but in the light oxidation was very much more accelerated in the case of white.

Another important point was the fineness of the pigment. The finer the pigment, the more thoroughly would it become incorporated with the oil. His experiments showed that after a pigment had been ground to a good commercial quality, say 200 mesh, then it had reached an efficient state of sub-division, and much finer grinding would only affect the paint to a small extent. The best result appeared to be obtained with 60 per cent. of pigment, which was about the percentage which practice had found to be best.

His experiments had also shown that several thin coats of paint retarded corrosion better than one thick coat. Actually, the best results were obtained with one thin and one thick coat of paint, so far as prevention of corrosion of steel was concerned. Whereas, however, in the case of surfaces exposed to the air, an increase in the total thickness of the paint prevented corrosion; with subaqueous surfaces there was an optimum thickness of paint, after which corrosion increased enormously. That optimum thickness was about 7 to 9 lbs. per 100 sq. ft. in the case of the subaqueous tests that he had made. Finally, reference was made to the effect of leaving mill scale on steel as a means of preventing or retarding corrosion. Although mill scale was a means of preventing corrosion, the point was that, in making up steel, the scale was broken in various places and moisture got in at these places and set up corrosion.



XUM

XUM

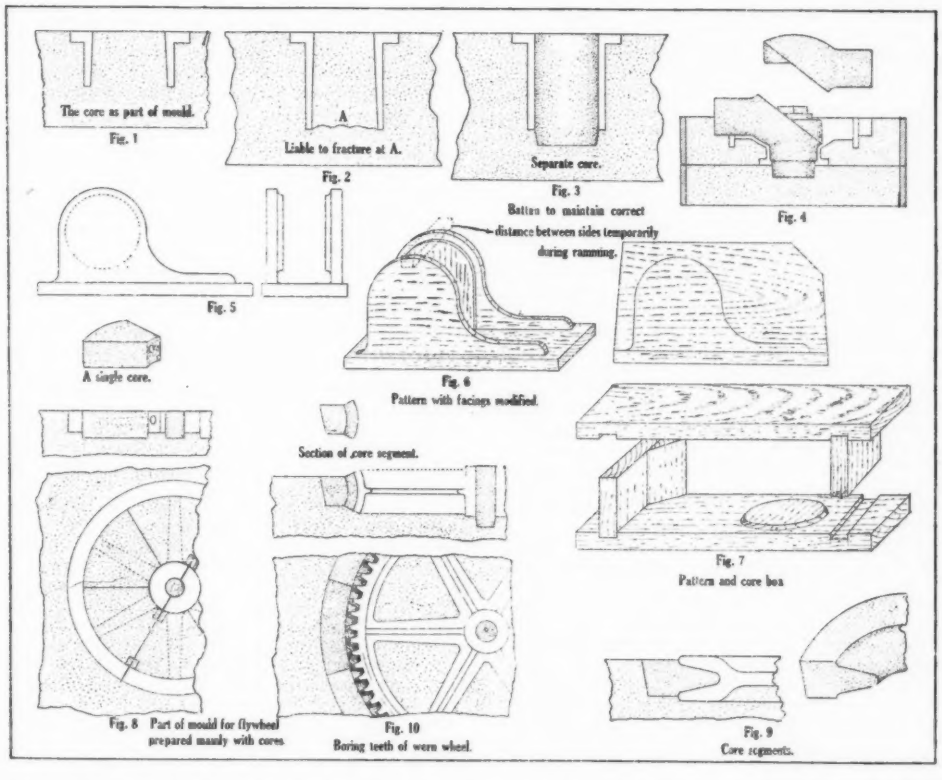
An Apprenticeship Course in Foundry Practice.—XV.

By Ben Shaw and James Edgar.

CORES AND CORE MAKING.

PART I.

Core making is usually referred to as having particular reference to that part of a mould which gives the central or internal shape of the casting. Although this explanation is suitable for giving general expression to the term, it is in practice applied to any body of sand prepared separately and introduced into the mould after the pattern has been withdrawn, and whether it defines the internal or external shape of the casting. The expression is also applicable to certain bodies of sand which are prepared in the mould, but in such a manner that they can be lifted separately, either in order to facilitate the withdrawal of the pattern or to allow other cores to be introduced. In a broader sense, the term core is also applied to the central body of sand left in the mould when the pattern is withdrawn, even though the temporary lifting of this body of sand may be unnecessary. Thus any body of sand which defines the internal shape of a casting, whether it be lifted or not, and any loose body of sand used for the external shape of a casting, may be termed a core, although in many instances other terms are applied to distinguish between various kinds of cores. Generally speaking, when the pattern-maker supplies suitable facilities for making the body of sand of the requisite shape, whether by means of core-box, strickle, core-frame, core-plate or skeleton shell pattern, the term core is applied, but when a full pattern is supplied from which the internal shape of the casting is obtained when the pattern is delivered, the central body of sand is frequently referred to as a "cod," and this expression is often used, even though it may be lifted temporarily. There is another type of core for which the moulder is mainly responsible, as no facilities are supplied to him other than the pattern—we refer to loose parts of the mould made to free the pattern or to introduce other cores, and when the moulder determines the shape, being guided only by the pattern; these loose pieces are sometimes referred to as "false cores," though they are more familiar as "drawbacks." To prevent any confusion in the use of these various terms we shall confine ourselves to cores which are made separately, and to those made in the mould from skeleton shell patterns.



Why Cores are Used.

Broadly speaking, the need for the use of cores comes under two categories—they are either a necessity or they may be used as an expedient. Cores may be said to be a necessity when the construction of the mould would be practically impossible without their aid, or even though the construction may be possible, when the sand which would otherwise be formed as cores, would be too weak to withstand the pressure of the metal. The construction of the pattern so that it would give the necessary impression for the internal shape must also be taken into consideration, as numerous joints would be essential in order to facilitate its removal from the sand. The additional joints and the cutting away of the pattern to make it a replica of the casting required would, in the majority of instances, render the pattern so flimsy that, if it were possible to obtain a mould, there would be considerable difficulty in its production. Not only would there be difficulty in manipulating the sand, but also in maintaining the correct positions of the various pattern sections, and afterwards, the various parts of the mould, so that the resultant casting would have that degree of accuracy which is obtainable from a more substantially constructed pattern, and which necessitates cores in the mould. The mould for a simple gland, for instance, as in Fig. 1, may be made without the aid of a separate core if the internal diameter is large enough compared to its length, and taper is given to the pattern so that it can be withdrawn easily without disturbing the sand. If, however, the diameter is small compared to its length, as in Fig. 2, it is difficult to withdraw the pattern, even though an excessive amount of taper may be allowed, without disturbing the central body of sand. Any light rapping which may be given to the pattern tends to break the connec-

tion of the central sand with the main body of the mould, and, in consequence, it is lifted with the pattern. There is no such difficulty when the pattern is only used to form the outside shape, and a loose body of sand or core is introduced for the central hole, as in Fig. 3, and moulds can be prepared more rapidly with less possibility of producing waster castings; also, incidentally, the holes are parallel, which is an economical consideration, seeing that it reduces the amount of metal machining. A more difficult example, although in principle similar, is illustrated by a mould for a valve in Fig. 4. It would be extremely impractical to attempt to make moulds from a pattern representing a model of the finished valve, however elaborately it may be jointed. From a solid pattern and core-box, however, the operation of preparing a mould is of a simple character, necessitating a single joint only, and the core can be accurately located when the pattern is withdrawn. Whether simple or intricate, the majority of castings require cores in the formation of their moulds in order to reduce the difficulties encountered in the manipulation of sand, and also in order to reduce the time expended in the preparation of one or many moulds, according to circumstances. When only one casting is required, its pattern may, in some instances, be a model of the casting, which may cause additional work in the foundry owing to the pattern leaving its own core, which would necessitate the adoption of some means of strengthening the central sand, and there would be the difficulty of obtaining a clean withdrawal. The additional work in the foundry, however, is more than compensated by the saving of a core-box in the pattern shop, but if many castings are required, it becomes a question whether the saving of time in the foundry if a pattern and core-box are supplied will be more economical. A simple illustration of this kind is shown in Fig. 5. For a one-off job the pattern can be quickly made similar to Fig. 6, a distance batten being dowelled on top, as shown, to ensure that the inside walls of metal will remain the correct distance apart when ramming. whereas should a number of castings be necessary, the pattern and core-box in Fig. 7 would be more economical, because little tooling, if any, would be necessary if the central shape of the bracket is cored out. This is an illustration of the advisability of using cores, not because they are essential, but in order to expedite the work when a number of castings are required.

Although the use of cores is cheaper when quantities of similar castings are required, in other instances cores may be used for a few patterns and a full pattern supplied for quantities. Thus the mould for a flywheel is frequently prepared in cores, the number depending upon the number of arms in the wheel. In such instances a block pattern may be used to give the external shape, but more frequently the shape is swept by means of a profiled edge board, and the cores are located in the impression, as shown in Fig. 8. If the wheel is of moderate size and many castings are required, it may be more economical to prepare a full pattern and dispense with cores, but with large wheels rarely indeed is more than one casting necessary for one size and shape of wheel, and the making of a full pattern would be an example of extravagance not usually associated with foundry work.

Other instances in which the use of cores make for economical production are illustrated in Figs. 9 and 10. The former shows a section of a mould for a rope pulley, the groove being cored out to facilitate moulding, whereas Fig. 10 is a section of a mould for a worm wheel, the teeth of which are sometimes formed by means of cores. In both these instances cores are used, not only to reduce the amount of jointing which would otherwise be necessary in the preparation of the moulds, but also to expedite production in the pattern shop. It is neither desirable nor necessary to make one full core to form the external shape, but a number of cores which when located in the mould will complete the full core. Thus, with the block pattern a sectional core-box is supplied, from which a definite number of cores will accurately form the full peripheral core.

In the preparation of larger and more complicated castings, cores are used to a considerable extent, not always because they are essential, but because the method increases the number of distinct operations; consequently more moulders can be employed, and the completed mould can be ready for casting in a shorter time than if many cores are dispensed with and the shape made in the mould. This, of course, does not necessarily mean that the production of the resulting casting will be cheaper, but that the time in which the casting can be delivered is reduced, a factor of importance when dealing with urgent work and in coping with increased business.

Green Sand Cores.

The same difficulties are experienced with green-sand cores as with green-sand moulds, but they are accentuated by the fact that cores mainly form the internal shape of a casting, and are therefore more or less enclosed in the molten metal when the job is cast. This undoubtedly increases the risk to which castings are exposed when green-sand cores are used, and the risk is increased according to the amount of surface in contact with the metal, and the reduction of outlet for the escape of steam and gases generated. Generally speaking, dry-sand cores are used when the risk of producing waster castings is greater than the saving of time obtained from the use of green-sand cores. This does not mean that there is no case for the green-sand core, but there are limitations to its usefulness. They can be profitably used in green-sand moulds of a repetition character when the area to be in contact with the metal leaves ample room for safe venting. In the making of aluminium castings they are frequently an advantage, providing free-venting is possible, because green-sand is a weak sand depending upon the moisture it contains for its cohesiveness to a considerable extent it is therefore likely to offer but slight resistance to the contracting metal This is an important consideration with aluminium, because of its high contraction and the low strength it possesses when hot.

Dry Sand Cores.

Cores are invariably dried, even though they may be required for a green-sand mould, and rarely, indeed, if ever are other than dried cores used for either dry-sand or loam-moulds. There is a greater safety attached to the use of a dry-sand core, and it can be handled more easily than a green-sand core.

Naturally-bonded sands are used to a considerable extent for the larger cores, many, in fact, being made of loam, the parts which are to form a surface for the metal being given a facing wash in order that a good skin will result on the casting; but it is important that the sand should peel from the casting, particularly from internal surfaces, and the application of blacking to core surfaces answers the purpose. Clay-bonded sands, however, become fairly hard when burnt through contact with the metal, and, not only is considerable difficulty experienced in removing sand so constituted from the internal parts of a casting, but it offers resistance to the contraction of the metal to such an extent that, unless special precautions are taken, the casting is fractured. When this is likely to be the case, with larger cores, it becomes almost imperative to use a sand which will become disintegrated under the heat of the metal, retaining its form and position only long enough for the metal to become solidified. For this purpose, carbonaceous substances are introduced as bonds instead of clay, or in addition to clay, which are burnt by the heat of the metal, and consequently the strength of the core is reduced, and it offers less resistance to the contraction of the casting.

Core Sand for Steel Castings.

The best of materials are necessary for this class of work. Steel moulders' "compo" is used to a considerable extent, particularly for large cores, because if its heat-resisting qualities; it, however, forms an exceedingly strong core, and, although the strength of the core sand in which it is introduced is varied to suit the work to be cast, for many classes of work, especially medium or small complicated castings, it is nevertheless unsuitable, being liable either to cause shrinkage cracks or unnecessary labour in fettling. For other than very large work, silica sand or sand such as the "Yorkshire" variety, which is comparatively free

from fusible impurities, is used. The silica sand used must be of a high grade, and, although china clay is more frequently used as a bond, sawdust is usually added also. Sometimes the cores made from the mixture are dried until the sawdust is partially charred, in order that they will be more readily crushed by the casting, but the heat of the metal is such that a considerable charring action is effected in any case, and the core is more easily removed from the cooled casting. Both flour and molasses, in combination, and flour alone, are sometimes used as bonds, although not very frequently. Cores so constituted require to be well supported, as the bond is partially destroyed during drying and the cores are more or less rotten. Silica paint should be applied to cores having the bonds mentioned, to give a strong face to the cores. Glutrin can be used with success as a bond for core sands to be used for intricate work; it is, however, very necessary to watch the temperature of the drying oven. In this case the bond sweats, it being drawn to the outside of the core by the heat, and a hard surface is produced, while the centre of the core is rotten. Should this outer skin be broken, the central sand will run out. This difficulty is somewhat obviated by using clay in conjunction with glutrin in the core mixture.

Core Sand for Aluminium Castings.

The temperature of molten aluminium is comparatively low; its strength when hot is also very low, and, coupled with this is the high-contraction factor of the metal; it is very important, therefore, that these be considered when the composition of the core mixture is in question. The more the core is surrounded with metal, the greater the care necessary in the selection of a suitable bond. A mixture may be used which gives a hard skin to the core when it is dried, and leaves a soft interior, then the soft interior of the core allows it to crush, and as the outside is disintegrated by the heat of the metal, there is no difficulty in removing the core from the casting. On the other hand, a bond may be used which softens by the heat of the metal, although maintaining the shape of the core until the metal has set. The softened core offers little resistance to the contraction of the casting, it being distorted readily by the gradual changing shape of the casting. Resin is the bond which fulfils this latter requirement, but when used the cores should be removed from their castings while they are warm, otherwise the resin which has not carbonised will again cause the central sand to become hard, which increases the time expended in fettling. Commercial core gum is frequently employed as a bond for the core sand from which the cores for aluminium are made, and, with care in the preparation of the mixture to suit the quality of sand used and the character of the work for which the cores are required, it gives successful results.

Core Sand for Brasses and Bronzes.

Core sand suitable for the common brasses varies considerably. In many instances the ordinary clay-bonded sands, prepared in suitable proportions from Birmingham Red or Mansfield Sands, are suitable for the purpose without artificial bonding. These mixtures are also applicable to the bronzes, which, by the way, need a close surface because of the searching character of the metal, but, although naturally-bonded sands are used, particularly for large cores and general work in jobbing foundries, the value of artificial bonds is unquestionably generally recognised, especially in foundries dealing with repetition work. For castings in these alloys it is not so much because of the contraction difficulty that artificial bonds are desirable, but because the time of cleaning them is minimised. Flour is frequently used as a bond, mixed in various proportions according to the strength desirable, or in some instances it is preferred to make flour starch, and use it for tempering the core sand. With the latter, sawdust is invariably introduced to open the texture, Molasses, too, is sometimes used to supply the necessary bond, but core mixtures containing this ingredient should be freshly prepared, as molasses water ferments if allowed to stand a day or two, and its bonding quality is diminished. It is therefore not a dependable bond. Dextrine or core gum as a bond gives quite successful results, and is prepared in many foundries, although care is necessary in drying the cores when this bond is used, otherwise they become fragile.

Core Sand for Cast Iron.

As with the brasses and bronzes, a wide variety of materials can be used to give the necessary bond for core sands for cast iron, the choice depending upon the work to be done. Thus, for intricate cores which must be strong and yet free-venting, oil-bonded sands are superior to other known artificial bonds. Oil sand cores have a distinct advantage in that they do not absorb moisture readily after they have been dried, an important consideration when they are used in green-sand moulds. Strengthening irons, such as would be necessary in a core composed of clay-bonded sand, are in many cases unnecessary, or almost entirely eliminated with oil-sand. Linseed oil is undoubtedly the best oil for the purpose, and many of the core oils and oil compounds have this oil as a base, other oils being introduced in the compounds with the idea of cheapening the bond rather than increasing its strength. Some of the blended oils resemble paint oils in that they carry resin, and although the oils themselves may have little bonding quality, they serve as carriers for the resin and form a more or less waterproof core. Although artificial bonds have come into prominence to a greater extent during recent years, particularly for core-sand mixtures, the clay-bonded sands will never be totally eliminated. Clay-bonded mixtures are cheaper when used for large cores, and the cost of bonded strength is undoubtedly a guiding factor. It is, of course, necessary to take the long view when deliberating the cost, and consider not only the first cost of the material, but also the additional cost of grids, plates, or irons which may be necessary for support, any difference in time occupied in preparing the core, the quality of surface on the finished core, the facility with which it vents, and the relative ease by which it leaves the finished casting. When the castings to be made are of a repetition character, artificially-bonded sands are cheaper, because all the facilities are in favour of repetition, and mixtures can be economically prepared to suit the work, the smaller and more intricate cores needing a stronger bonded sand, whereas the larger cores, because of their bulk which assists the core in maintaining its shape, need less bond. In the making of large castings core-loam is not likely to be displaced, as it is readily prepared, and it can be used with all forms of core-boxes, supplied to jobbing foundries.

No effort has been made to give definite mixtures for core sand, as we believe a mixture conveys little to the reader unless he is likely to use similar sand for similar work. This is one special sphere in which experimental work is of first importance, and while facilities are not usually available in foundries, those students who are alive to the necessities of progress, and who attend the many foundry classes which are now organised, would do well to consider this subject particularly. There are some general considerations which can be given here relative to artificially-bonded sands. It is better, for instance, that the sands used should be as free as possible from clayey matter, such as are known as weak sands, and invariably it is desirable that they should be dry when the bond is added, as this gives a better chance of more thorough mixing, and, incidentally, a more regular composition can be assured, because the amount of moisture a damp sand contains is an unknown quantity. When possible, the bond should be mixed with water to be used for tempering the sand; in the case of oil it should be emulsified with water, in order that it may be carried to every particle of sand. Core-sand should be specially ground or thoroughly mixed by mechanical means, to ensure thorough incorporation of the bond with the sand. With clay-bonded sands or loam core mixtures and other carbonaceous materials, besides sawdust, which are frequently added, are cow hair and chopped straw, both of which act as bonds as well as openers, and coke breeze ground with the mixture opens the texture of an otherwise close and strong sand, and is, as a rule, more effective than either sharp or sea-sand for the purpose, although the latter may be added to reduce strength when the texture is sufficiently open for venting.

XUM

The Influence of Phosphorus on Brass.*

By A. Portevin.

A French writer has recently made a number of experiments to show the effect of various proportions of phosphorus on brass. Two series of brasses were made with an increasing proportion of phosphorus, added in the form of phosphor-copper containing 10 per cent. The first series averaged 68 per cent. copper and the second 58 per cent. Tests were made from both series cast in sand and in chills, the latter being in the form of round bars 45 mm. (1¾ in.) dia. Each test piece was analysed, tested for tensile, hardness and impact.

Since the results of mechanical tests on cast alloys are subject to a number of factors, they must be considered as a whole rather than as representing great accuracy individually.

Table I.—*Brass Cast in Sand.*

Chemical composition of all the brasses. Pb. = O. Sn. = O, or traces.			Tensile test.				Hardness. Ball 10 mm. dia. under		Impact on notched bar.	Hardness. "Shore."
Cu. %	Fe. %	P. %	Ult. Tons sq. in.	Elastic limit. Tons sq. in.	Reduction of area. %	Elongation. %	2,200 lbs.	1,100 lbs.	Kgr. m. per sq.c.m.	
68.94	0.06	0.000	6.8	2.9	20.0	20.5	—	25	12.0	11.00
69.15	0.07	0.029	7.6	4.3	25.5	21.8	—	29	12.0	10.25
68.79	0.06	0.077	5.6	3.0	12.0	20.5	—	28	10.8	11.00
68.17	0.16	0.51	4.8	4.4	4.0	7.0	—	32	2.5	19.00
67.10	0.06	0.66	8.0	0.14	7.0	8.4	42	—	1.6	19.00
66.65	0.07	1.47	8.5	6.80	2.5	0.0	55	—	1.2	21.00
2nd series averaging 58% copper.										
59.01	0.10	0.00	22.2	5.40	44.0	41.0	74	—	16.0	21.75
59.29	0.15	0.20	22.4	8.10	36.0	43.2	61	—	11.5	21.50
58.93	0.07	0.07	21.8	8.25	33.0	39.8	60	—	11.3	22.50
58.65	0.22	0.48	Snapped when tightening machine.				65	—	3.6	21.25
57.83	0.05	0.64					73	—	1.3	22.00
57.08	0.11	1.19	9.5	9.5	1.0	0.0	83	—	1.1	29.75

Table II.—*Brass Cast in Chills.*

Chemical composition. Zn. used was free from Bi. and Sb. As. = 0.015%.						Tensile test.				Hardness, ball under	Impact, notched bar.
Cu. %	Pb. %	Sn. %	Zn. %	Fe. %	P. %	Ult. Tons sq. in.	Elastic limit. Tons sq.in.	Reduction of area %	Elongation. %	Lbs. 4.400	Kgr. m. per sq.c.m.
1st series averaging 68 % copper.											
68.57	0.74	traces	30.53	0.13	0.000	—	—	—	—	54	7.20
69.47	0.63	—	29.37	0.45	0.033	10.2	7.0	11.0	18.0	64	10.6
69.56	0.49	—	29.60	0.25	0.071	12.3	6.3	18.0	24.0	64	8.1
68.62	0.58	0.08	30.13	0.15	0.38	—	—	—	—	74	4.0
69.25	0.44	0.16	29.20	0.22	0.69	13.2	7.7	7.0	8.0	82	1.75
68.12	traces	0.13	30.07	0.24	1.38	—	—	—	—	95	1.55
2nd series, averaging 58 % copper.											
59.53	traces	traces	40.33	0.09	traces	25.2	9.1	39.0	39.0	93	7.5
61.14	—	—	38.48	0.29	0.046	23.0	8.3	40.0	39.0	80	11.8
60.47	—	—	39.27	0.18	0.059	22.6	9.4	26.0	33.0	86	10.1
58.76	—	—	40.77	0.07	0.38	—	—	—	—	121	1.25
58.16	—	0.03	40.87	traces	0.86	4.5	4.5	00.0	00.0	128	1.25
57.08	—	0.05	40.94	0.12	1.73	—	—	—	—	141	1.25

From an examination of Tables 1 and 2, it will be seen that the mechanical properties are not sensibly affected so long as the phosphorus content remains below 0.05 per cent. When the proportion of phosphorus exceeds 0.5 per cent., a rapid fall in ductility and elongation takes place. The metal becomes brittle as the hardness increases. The great fall in ductility shows how entirely fallacious are the ultimate tensile strength and the apparent elastic limit when considered alone.

These tests have clearly demonstrated the danger of considering mechanical tests from the point of a few figures only. They also show the great differences resulting from the rate of cooling, and how useless it is to consider the results furnished by test-pieces that have been cast separately as indicating the quality of a casting.

The presence of phosphorus in these brasses is casual, not intentional, since it does not play the part of a deoxidiser, that function being carried out by the zinc. In conclusion, it can be stated that the presence of phosphorus to the extent of 0.05 per cent. is not harmful to brasses of the quality stated.

* Extracted from a Paper presented to the Nancy Congress before the Association Technique de Fonderie.

Complimentary Dinner to McLain.

A complimentary dinner was given to Mr. David McLain on his returning to America at the Central Station Hotel, Glasgow, on Oct. 13.

The Chairman, Mr. John Cameron, was most eloquent in his praise of the McLain system, and from his own experience he advised everyone connected with the ironfounding trade to take the McLain course of lessons.

In his reply Mr. McLain expressed his heartfelt thanks at the very great honour the McLain students had done him that evening. He was going home with most pleasant memories of his stay in this country, and hoped to return again next spring.

The toast of "The Foundry Trades" was proposed by Mr. James K. Shanks, to which Baillie John King replied. Mr. Walter Mitchell proposed the toast of the McLain Students, which was replied to by Mr. Geo. Albert Ure.

The musical programme was in the hands of Mr. John More, Mr. William Shanks, and Mr. John Wright.

Amongst those present were Messrs. Matt. Riddel, Past-President, Institution of British Foundrymen; Donald M. King, T. P. Cameron, Hugh M. Hodgart (President, Scottish Branch of the Institution), and Professor Campion.

It was announced during the evening that Messrs. Grimes, More & Company, of 11, Bothwell Street, Glasgow, had been appointed agents in Scotland for Mr. David McLain.

Institution of British Foundrymen.

BIRMINGHAM BRANCH.

The opening meeting of the session took place at the Municipal Technical School, Birmingham, on October 14, when the President (Mr. W. J. Flavell) delivered his address.

Mr. H. Field said it was their good fortune that night to have present Mr. H. L. Reason, who was not only a past President of the Branch, but the President of the Institution, and he thought it was only fitting that Mr. Reason should take the chair.

The Secretary (Mr. D. Wilkinson), having read the minutes of the annual meeting, which were approved, announced apologies for absence from Professor Turner, and Messrs. R. Buchanan, Ball and Winterton.

In inviting Mr. Flavell to deliver his address, Mr. Reason spoke in appreciation of his valuable work for the Birmingham Branch. Mr. Flavell, he said, had been regular in his attendance at Council meetings, and he had always regarded him as one of the stalwarts of the Branch.

Presidential Address.

Mr. Flavell, who was very warmly received, then gave his address:—

Gentlemen,—Last session was one which I can speak of with a great amount of satisfaction, for it marked an epoch in the history of the Institution of British Foundrymen, which we are not likely soon to forget. I refer to the Exhibition and Competitions in Bingley Hall. Speaking proudly, it was in every way a magnificent success, and reflected great credit on all who had the arrangement of the work. Members of the various Branches expressed repeatedly their pleasure at being amongst us, and desired in every way to show their appreciation of all that was done to make their visit happy and enjoyable.

It is also with feelings of pleasure that I call to your notice the signal honour that has been conferred on this Branch by electing on of the members, Mr. Reason, to fulfil the office of President for the ensuing year. Those of us who know him are fully aware that he will preside over the affairs of the Institution with moderation and wisdom.

With reference to the coming Session, I should have had greater pleasure on this occasion if trade were good, but it does seem as though there is a slight tendency for better times for all. There is undoubtedly an increase in the amount of inquiries which are being made in connection with the foundry trade generally. To speak more closely of the work of our Branch we are, as all are aware, the nucleus of the Institution. It was initiated in Birmingham, and it must be a great source of satisfaction to those, some who are still among us, to see how the Society has grown in volume and usefulness.

Local Foundry History.

Within a few miles radius, some of the first great historical events took place, as for centuries past the foundry trade has been in existence round about us, some of our foundries and blast furnaces dating back 200 years. The work that was done in those early days is still in existence, not only in our immediate neighbourhood, but all over the world. It is rather surprising that a comparatively small town like Wednesbury should be, without doubt, the "Mother of the Midlands." This town was erected by the Founders of Mercia, in A.D. 577, which, at that early date, enjoyed a civic status and possessed burghal government. As a burghal centre, it is older than the county town of Stafford or the City of Lichfield.

There is no doubt that the destiny of these Midland towns was irrevocably settled at the Creation, the masses of useful mineral wealth which nature deposited close beneath the surface, pre-ordained it to become in the evolution of human civilisation, what in the parlance of the practical language of to-day is called the coal and iron district. In my own recollection, little more than a scratch on the surface revealed rich stores of that most useful of all minerals, and lying close beside it the fuel wherewith to smelt it, and even the lime to flux it in the furnace.

Before the year 1500 coal was being dug in the neighbourhood, though its utility, when chimneys were unknown, was at first scarcely recognised. Two centuries elapsed before the immense usefulness of this mineral was fully recognised. In Elizabeth's reign the tenants of the surrounding small hamlets were going to the High Court of Chancery to establish their right to dig coals for their own use. The use of coal was supplied first of all to domestic purposes, but the extension of its use to the working of iron and other metals followed soon afterwards. As in the reign of James I., it was being burnt on hundreds of smith's hearths all around the district known as the Black Country. But the great problem of two centuries which still remained unsolved, notwithstanding repeated experiments, was the use of mineral coal for smelting the iron ore in the furnace. Of the experiments of Dud Dudley, at Sedgley, about 1620, it would be superfluous to speak here, but a Wednesbury experiment may prove of interest.

In 1675 Frederick de Blewstone, a German inventor, came to Wednesbury and erected a furnace, in which only the flame of a coal fire came in contact with the iron ore. It ended in failure, and although the principal was right, it seems to have been the inability to produce sufficient blast to ensure the complete combustion of the coal. It was repeatedly proved how inadequate it is to blow a coal-fired smelting-furnace with leather bellows worked by oxen or horses, or even by human labour, which was sometimes employed.

We now know that what the manufacturer was really waiting for was a power greater than any animal power could supply. In 1781 James Watt completed the invention of the steam engine at Soho, and at Bradley, near Bilston, in 1785, John Wilkinson first applied a steam-engine to blow a blast furnace. Bradley Furnace was therefore rightly named the "Mother of the Black Country Furnaces." From this period onwards this district began to assume more and more importance in the march of industrialism.

No pen can describe the aspect of the early Victorian Black Country as that of Charles Dickens has done. During the cholera visitation in 1832, the great novelist passed through on a coach, and he afterwards recalled his impressions in the "Old Curiosity Shop" in describing the wanderings of those immortal characters, Little Nell and her Grandfather.

After 1785, when blast furnaces were springing up, the foundry trade began in the Midlands to assume the proportions as it is to-day. Many and various have been the alterations and improvements since those early days. Its pioneers have all passed away, and foundrymen are expected to carry on and improve upon the work which they started, and there exists no better means for mutually assisting that trade than the Institute of British Foundrymen. Its programme is almost never ending, for it deals at various times and places with every conceivable subject in the foundry industry. Its work is purely voluntary, and is given for the benefit of everyone of its members.

The Institution and the Pattern-Maker.

This address is to be followed by a discussion, but up to now little has been said which is debatable, but there is one item to which I should like to give expression, and that is, how does the Institution help the patternmaker? Sometimes we forget what an important part he takes in the foundry trade, and his position does not give opportunities for the reading of Papers, and this is quite a mistake. How can we adapt ourselves to give to the patternmaking branch of the foundry trade more inducement to join us and so increase our membership and usefulness? We are living in a time when all the experience and knowledge that can be acquired will be necessary for the coming generation, if they are to keep up with the pace of competition all over the world. If the pattern-

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maker is a man who is content to work at the bench all his life, there is little to be said, but if he has ambition and wishes to attain to any position of eminence, he must not only be able to use his tools, but he must extend his studies and knowledge until he has made himself conversant with foundry practice generally. I have known many men of this class, and some have been of the highest type of foundry men. The same remarks apply to the moulder. Should he determine to get along he must not only study how to make a mould satisfactorily, he must also have a good knowledge of metallurgy and chemistry. He must know how a certain thing is done and why it is done to get the results desired. Chemical analysis is excellent for a man to understand, but there is a great deal in this which can be very often misleading. There is that practical knowledge gained by close study, which is only attained by hard work and experience, to produce in the casting what he has found in the pig before smelting. What our object is is obvious. It is to give by papers and discussions something which our members may not have possessed.

Vote of Thanks.

In proposing a vote of thanks to the Branch-President for his Address, Mr. Reason said they were very fortunate in having as President a practical man who had served his time and understood the wants of the industry. He had given them a review of the ironfounding industry in the Midlands, and it was interesting to hear what an important position was held by Wednesbury in the industrial development of the district, although it had been surpassed to-day by the great manufacturing centres close at hand.

Mr. J. B. Johnson, in seconding, said he had known Mr. Flavell as a workman, as a trades unionist, and as a close personal friend. They had had many able presidents in the past, but he was confident Mr. Flavell would fill the position equally as well as any of his predecessors.

The motion was enthusiastically endorsed by the meeting.

DISCUSSION.

Mr. Reason said the President had raised the question as to how they could encourage pattern-makers to take more interest in the Institution, and he had also said that if the moulders of to-day were ambitious and wanted to go forward they could not do better than join the Institution and take part in its work. He could not say what was the percentage of patternmakers in the Institution, but it was quite a respectable number. In fact, he might say that the principals and foremen and managers of the largest engineering concerns in the country, and the foremen of the different pattern shops, were members of the Institution, and realised that their membership was necessary if they were to keep abreast with modern methods. With reference to moulders or other foundry workers wishing to improve their position in the industry, he admitted that there was this difficulty, that after a full day of hard and laborious work a man had little energy left for attending evening classes, and when Saturday afternoon came he looked forward to recreation rather than to further work. It spoke volumes for the men who, after a hard day's work, took up studies in the evening and also attended the Institution meetings on Saturdays. He often marvelled at the attendance they had at their meetings, for it could be considered as a prolongation of working hours. But he ventured to say that once they crossed the threshold, attended the meetings and secured some enlightenment on the technical side of the industry, what might look like work at first sight would be transformed into recreation. When he (Mr. Reason) first attended the meetings of the Branch many years ago he came with a certain amount of diffidence, but to attend a meeting of foundrymen to-day afforded him as much enjoyment as going to a place of amusement. Indeed, if he missed a discussion he felt he had missed something which he might perhaps never have an opportunity of recapturing, because no matter what the subject was that was under consideration they were always likely to learn something.

Parochial Outlook.

Mr. H. Field emphasised the value of the Branch meetings from the point of view of gaining by other people's experiences. Men in the pattern shop of a foundry, for example, were inclined to follow their own methods without going outside and learning from more advanced methods, perhaps, elsewhere. They might be far behind the times without being conscious of it, and if they came and saw what other people were doing it might stir them up. Mr. Flavell had referred to Wednesbury and its apparent pre-ordination to be one of the centres of the manufacture of iron. In his opinion the pre-eminence of the Black Country in that respect was fast passing away. He did not think any new iron and steel plants would be erected in the district. The puddling industry was rapidly disappearing. The furnaces here were not so up-to-date as in other districts. He thought the district was destined to become a manufacturing district, such as Birmingham, and not a district for the production of the raw materials of engineering.

Replying to Mr. Field's point as to the future of the puddling industry in the Black Country, Mr. Flavell admitted that it was undoubtedly on the decline, but said the explanation was that steel was taking its place. Steel was brought into the Black Country from various centres in the form of billets cut off into lengths and rolled down, and was taking the place of the old puddled wrought iron in a great many cases.

Necessity for Co-operation.

Mr. A. Wardle spoke of the lamentable lack of co-ordination between the various departments in foundries, and laid stress upon the importance of seeing the other man's point of view. The moulder often objected that a pattern submitted to him was not a practical thing to make, but if it became practicable to make it the draughtsman and the engineering industry would have more scope. At present designs, particularly of automobile work, were only limited by what it was possible to get made. In many cases they found draughtsmen, through ignorance, putting designs on paper where the same result could have been obtained by simpler means, from the standpoint of the moulder. He thought the Society might be the means of helping to eliminate misunderstanding and the want of co-ordination which at present existed.

Lack of Education.

Mr. A. Parsons expressed the opinion that the smelting of iron ore was largely due to the pioneer work of Dudley, and to-day, he said, they were reaping the benefit in having such a wide range of selection of materials for foundry work. Since the close of the last session he had canvassed the foundries of which he was foreman, and he found a spirit of indifference among the moulders with regard to the Institution and its work. He had described to them the work done by the Institution for the uplifting of the moulder, and the invariable reply he got was that "They cannot tell me anything that will do me any good." He thought they were wrong in their attitude, but how was it possible to demonstrate to them that by means of the Institution they would get information which would help them along on the technical side particularly, and give them a broader outlook on their work? Of course, they got practical knowledge in the foundry, but the majority appeared to think that there was no technical side. The moulder was content with methods which enabled his predecessor to turn out a good job, and was rather reluctant to have new ideas put to him. In his opinion, the employer was more responsible than anybody else for that point of view on the part of the practical moulder. He did not think employers gave them sufficient encouragement. The moulder had his job to do, and the employer wanted him to see it through, and had no inclination to let him spend part of his time with the foreman or anyone else who could give him some information on the job in hand. It was because no one took a keen interest in the moulder on the technical side of his job that the moulder was indifferent when an appeal was made to him to join such an Institution as theirs. Prob-

ably the same reason accounted for the apathy of other branches of the trade.

Narrow Outlook of Foundrymen.

Mr. E. H. Tyson agreed that it was a difficult matter to persuade either patternmakers or moulders to come to those meetings. Many of the men did not take sufficient interest in their work to be willing to sacrifice time and effort in order to make progress. Their feeling with regard to a job was "If it is a good one, all well and good; if it is a waster we will make another." They would risk a scrap casting rather than make sure of getting a good one. Nevertheless there had been a big advance in the foundry trade. When he was patternmaking in Coventry about 25 years ago he took a water-cooled cylinder to a foundry. It was the first one he ever made. When the foreman saw it he said, "What do you take moulders for?" "Do you think a moulder can make a thing like that?" To-day it would have been a simple job in a foundry, but the firm in question would not have anything to do with it. The result was that he had to take it to another foundry, where they managed to get a good casting.

The Future of the Black Country.

Mr. D. Wilkinson insisted upon the importance of taking a broad view of their work, realising how intimate was the relationship of their particular job with other people's work, and that each man contributed something to the sum total. They ought to look upon their work, he said, as being allied with the advancement and uplifting of humanity. If they took such a view as that they would cease to be interested merely in their own little affairs. They frequently found when a pattern came into the shop that it could have been treated in such a manner as to have saved a large amount of trouble and effort in forming the mould, without any additional cost or labour in the pattern shop. Similarly, if the moulder took a broader view of his work he would be less carpingly critical of the quality of patterns sent to him. If patternmakers realised that their work was not finished when the pattern went out of the shop, but that it had only then really begun, they would take more interest in foundry work. He had been told by several patternmakers that when they came to be attached to a pattern shop connected with a foundry they had been surprised at the improvement they could make without any additional cost. There was nothing like broadening one's point of view to enhance one's value. The great thing that was holding back engineering was the want of co-ordination and of mutual appreciation and assistance in tackling problems. If there was mutual understanding and help before money was spent, economies could be effected, and there was no doubt that unless economies were effected trade could not improve and prosper. He did not agree that the Black Country was in any degree played out. When they remembered that in America ores were transported a matter of a thousand miles or more it widened their view of how the trade of the Black Country might be maintained and improved. He thought he was right in saying that so far as the manufacture of iron was concerned, and especially puddled iron, one of the largest manufactories of puddled iron in the world was at present in the Black Country. It was certain that if the men in this neighbourhood would cultivate the habit of looking at things from a broad point of view and get over their little parochial attitude, a fresh era of prosperity would open out before us.

Draughtsman Controlling Factor.

Mr. F. C. Edwards thought that if the men could be once got to attend a meeting it would be possible to hold them. The difficulty was to get them to break the ice. The draughtsman was the controlling factor in the situation, and very often through ignorance he placed more on the moulder than the latter could bear. He thought it would be a good thing if patternmakers could spend six months in the foundry.

Mr. Reason thought that if they could get a good attendance of men from the foundries it might be possible to stimulate their interest by the cinematograph or lantern slides showing various processes. He added that last year a number of vacancies were filled by people writing to the Institution when they wanted men, and in his opinion that was a movement which was bound to grow. It will readily be appreciated how this enhances the value of the Institution.

The Author's Reply.

Replying at the close of the discussion, the President said many of the observations made were interesting. Mr. Wilkinson had spoken about breadth of view, and he agreed that it would be most valuable if they could induce the men in the works to look with anything like breadth of view upon their occupation. It was difficult, however, because with the march of commercialism trade had become more monotonous. More machinery was used, and no great demand was made upon individual intelligence. A man's movements were to a large extent automatic; he did one little part of a job and that was all he had to do with it. To get the breadth of view of a millwright, for example, in the old days was now very difficult indeed. He felt that if they could get the patternmaker and the journeyman moulder to become members of the Institution it would broaden their knowledge; they could obtain information that they perhaps lacked, and do themselves good and do the Society good at the same time.

WEST RIDING OF YORKSHIRE BRANCH.

At a meeting held on October 14 in the chemistry theatre of the Bradford Technical College, Mr. A. A. Liardet, Branch-President, in the chair, Mr. Oliver Stubbs, a past-president of the Institution, gave an address on "Impressions of the American Iron Foundry Business." More than forty members were present, which, taking into consideration the recent formation of the Branch, is distinctly encouraging.

Sheffield Foundry Trades Technical Society.

Before introducing his subject, Mr. Stubbs commented on the formation of a foundry technical society at Sheffield, where a strong branch of the Institution has been in existence for fourteen or more years, stating that such a society was quite unnecessary. It was a pity such a society had been formed, and it was to be hoped that no members would be enticed away from the national organisation.

AMERICAN IMPRESSIONS.

Before stating his actual impressions, the lecturer pointed out that at the time of his visit (April, May, and June last year) trade was just beginning to pick up, some of the foundries having been shut down from twelve to eighteen months. The largest foundries are those associated with the automobile industry. General foundry business was fairly good, but the malleable trade had not then recovered from the depression.

The two outstanding features of American foundry practice which cannot fail to impress any Britisher are the class of labour employed and the systems of transporting materials inside foundries.

With regard to the former, it should be pointed out that every nationality is to found working in foundries, with a distinct preponderance of the black element, especially on moulding machines. During the recent war the coloured population made immense progress. There are specially large quarters to be found in the large cities where the population is entirely black. There are other distinct sections favoured by the Irish, German, Jewish, and Latin elements. This necessitates an organisation in works totally different from anything in this country. In some cases workpeople are totally unable to converse with each other. Notices have to be exhibited in a dozen or more languages. Obviously such a heterogeneous collection, when once initiated into their work, makes for production, as their principal object in life is to earn the maximum amount of money that can possibly be obtained from their piece-work system

Transport.

With regard to transport, the Americans can teach us much. They have so designed their shops that the material is transported overhead by means of electrical travelling cranes, monorails, conveyors, or other systems, allowing of the maximum use of floor space. Obviously the first essential for such systems is good buildings, and it can safely be stated that the majority are good. Here and there, however, especially amongst the jobbing foundries, there still remain some poor old-fashioned shops. A factor which may have contributed to this extensive use of conveying units is the American law which prohibits women from carrying more than 18 lbs.

Malleable Industry.

Perhaps no metallurgical industry in recent times has gained more from technical research than the malleable-iron industry of America. For instance, the National Malleable Foundries of Cleveland turn out some 2,000 tons per week. To accomplish this a continuous annealing process has been satisfactorily established. The core making is quite mechanical and standardised. The various sands and oil are measured out in definite quantities and automatically mixed. The mixture is conveyed to women operating handy machines. The cores are in turn conveyed into the drying stoves, which are continuous, and when dried conveyed to the moulders, special precautions being taken to prevent any jarring.

Pig Iron.

Pig iron is practically always machine cast. The benefits to be derived from this were outstanding in Great Britain, when during the war not merely was sand adhering to the iron but even fair-sized pebbles. This is a subject which requires energetic study and action by British foundrymen. The pig, on arrival at the works, is handled by cranes with magnet attachments. It is weighed in special trucks and conveyed direct to the furnace platform, or in many cases the cupola itself. This latter method is adopted at the International Harvester Company of Chicago, where special attention is paid to both weighing and chemical analysis. The metal leaving the cupola is likewise weighed by the insertion of spring weighing machines, being the crane hook and ladle. Additionally, charts are prepared and exhibited in the foundry indicating the tendency of the silicon, manganese, sulphur, etc., to rise or fall. Another chart gives the daily amount of wasters, which are carefully investigated, and the reasons for the defect is ascertained, assigned, and if possible remedied.

Core Making.

Perhaps the most interesting core-making machine seen by the lecturer was one designed by an engineer associated with the Westinghouse Brake Company. At the time of the visit it was engaged upon 4-in. stop-valve body cores. The top half of the box had holes drilled through it, by means of which the core was rammed entirely pneumatically. Of course, this was more or less of a novelty, the core- and mould-making machines which are most used are the Pridmore, Tabor, and other makes quite well known here. The tendency with moulding machines is to install electrically-operated compressed air machines. Female labour is extensively employed in the core shops. The blacking most extensively used in the States, both for moulds and cores, appears to be a mixture of ¼ machine oil, ¼ petrol, ½ plumbago. It is applied by means of a spray instead of by a brush.

Speed Limit.

At the Westinghouse Brake Company's Works Mr. Stubbs was informed that a moulder is using the same sand every 35 mins. The moulds work on island turntables. The system being that one man does a definite job, and that finished, the table turns, putting the box before another operator, who carried the work a little further. Very shortly it comes into the teeming position. After casting it is taken to a bumping grid, where the sand falls into a cellar; the casting is conveyed to the fitting shop, and the box back to No. 1 operator. The sand is conveyed to the sand preparing plant, where definite quantities of new material are added and mixed. The sand is then taken by bucket and overhead conveyors to a chute situated above the turntable.

It is impossible to overstate the care bestowed upon the patterns utilised for this mass production. Before sending a pattern to the foundry, it first goes to an experimental foundry, where it is thoroughly tried out.

A Cylinder Testing Economy.

Obviously, in works of the magnitude of the Ford Works, a considerable power is daily generated in the testing of automobile cylinders. This it not allowed to be dissipated, but is utilised for the production of power by means of small dynamos.

An interesting job made on a moulding and noted by the author was a carding cylinder, 40 in. long and 50 in. diam. It weighed 1,200 lb. The jarring machine used rested on concrete foundations, weighing 120 tons, but in spite of this considerable vibration was experienced. All such machines as this are provided with a sand chute, placed conveniently for filling the box. Of the pattern in question four men made eight castings per day, and the price charged to the machine shop was 3 dollars (13s. 5½d.) per cwt.

Welfare Work.

During and since the war the Americans have made tremendous progress in welfare work, which extends to the home of the worker. The works are well provided with modern lavatories, bath rooms and mess rooms. Baths and washing are carried out in the workman's own time, and as far as the lecturer could judge, the washing facilities were not rendered inoperative through the misuse of tea leaves. In the cafeterias—mess-rooms—concerts and lectures are provided during the lunch hour, some of these having wireless installations for this purpose.

Fettling Departments.

These he found to be conducted on the best lines, so far as transport and hygiene were concerned. Extensive use is made of the excellent systems of sand blasting apparati in vogue there.

Finally it should be emphasised that in the States full recognition is given to the foundryman as a high-class specialised worker.

Votes of Thanks.

The Branch-President, in calling upon Mr. V. C. Faulkner, the Editor of The Foundry Trade Journal, to propose a vote of thanks confirmed the lecturer's impressions as to the heterogeneity of the labour employed and to the excellence of the American systems of handling material.

Mr. Faulkner, in proposing a vote of thanks to the lecturer, said that British foundrymen had much to learn from American practice. He also was of opinion that much benefit could also be derived from a study of Continental conditions, a matter which was much more easy for the majority of the members. Next autumn an International Foundrymen's Congress and Exhibition is being held at Paris. Members had been invited by the Association Technique de Fonderie, but the Council of the Institution had decided against holding their Congress there. However, The Foundry Trade Journal would consider organising a visit to France should a definite desire be found to exist amongst foundrymen. He had great pleasure in proposing a hearty vote of thanks to Mr. Stubbs for his most enjoyable lecture.

Mr. J. Robinson seconded this, pointing out the valuable work which Mr. Stubbs had done for the Institution during his short term as President, and was happy in the knowledge that he was to take office again next year. The vote was carried with acclamation.

Mr. Stubbs in acknowledging, stated that it was one of the happiest years in his life, and whilst he looked forward to another year in office, they must not expect anything on so pretentious a scale as the Birmingham conference.

The remainder of the evening was devoted to an appeal by Prof. Charnock for the support of local foundrymen in the conduct of his apprenticeship classes, and discussions on "Scientific Cupola Practice" and "Impurities in Cast Iron."

The British Cast Iron Research Association.

Appointment of Director of Research.

The Council of the British Cast-Iron Research Association have offered the important position of Director of Research to the Association to Dr. Percy Longmuir, M.B.E., of Sheffield, which he has accepted. He will take up his duties on November 1.

Dr. Longmuir is one of the foremost recognised experts in cast iron, and the appointment is of the greatest importance not only to the ironfounding industry all over the country, but to the engineering and allied trades. His connection with the industry dates from 1897, and his career as foundry apprentice, foreman, manager, and finally as director, shows that he has passed through all the necessary practical stages. His metallurgical training was received under Professor Arnold at the Sheffield University, after which, in May, 1902, he was awarded a Carnegie Research Scholarship by the Iron and Steel Institute, and this was renewed in 1903, culminating in the receipt of the Carnegie Special Medal for his Research on "The Influence of Varying Casting Temperature on the Properties of Alloys" and

Dr. Percy Longmuir, the newly-appointed Director of Research to the B.C.I.R.A.

on "The Properties of Iron and Steel Castings." This research work was followed by a further period of research work at the National Physical Laboratory. The result of this work, in collaboration with Sir Robert Hadfield and Professor Carpenter, was published in the report of the Alloys Research Committee of the Institution of Mechanical Engineers.

Upon leaving the National Physical Laboratory to take up foundry consultant work at Sheffield, Dr. Longmuir was one of the first external examiners in metallurgy appointed for the Sheffield University. From 1909 to 1919 he held the post of works manager at the Stocksbridge works of Messrs. S. Fox & Company, Limited, and is at present the Technical Director to Messrs. H. Rossell & Company, Limited, Sheffield.

Dr. Longmuir has been a very prolific writer of technical papers to various Societies, the Iron and Steel Institute Proceedings containing no less than ten of his contributions. He was joint author with the late Dr. A. McWilliam of "General Foundry Practice," and also published "Elementary Practical Metallurgy," two well-known standard works.

Dr. Longmuir was one of the founders of the Institution of British Foundrymen, and President in 1910 and again in 1911. Apart from his keenness for original research, he is intensely interested in the training of the worker, and for some years has frequently lectured to the numerous Sheffield technical societies. Last week he was elected President of the Sheffield Foundry Trades Technical Society.

Although the work that lies before the new Director is enormous, Dr. Longmuir's ability and knowledge will, without doubt, be equal to it, and the Council of the Association are to be congratulated upon the appointment, which shows the earnestness of their desire to improve the cast-iron industry.

Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

Certificated Foundrymen.

To the Editor of The Foundry Trade Journal.

Sir,—In reading the report of Mr. Young's presidential address to the Newcastle Branch of the Institution of British Foundrymen, which appeared in your journal, I was particularly interested in that part which referred to "Certificated Foundrymen."

It is rather surprising when we realise it that, with the exception of the foundry trades, all important industries have their recognised examinations, the successful passing of which carries the recognition of ability, according to the standard of examination passed. The certificates and, in some instances, medals which are granted are recognised to a more or less degree mainly because they represent the successful result of a course of study in the subject on which the examination has been based. These examinations have undoubtedly an important influence in raising the status of the members of the industry to which they refer. I am therefore entirely at one with Mr. Young that our pressing need is to have some form of test or examination for which members of the foundry trades could work with a desire to hold certificates in their own subject.

Personally, I am of the opinion that if the Institution would decide to hold periodical examinations, the desire for improvement on the part of foundry workers, although probably not at once apparent, would eventually assert itself, and the one important result would be the improvement in status of all concerned with the foundry, whether they were apprentices, journeymen, or foremen.

It is not necessary at this point to make any suggestions respecting the standard of suitable examinations, nor yet is it important to consider the manner in which a certificate will be referred to, that would necessarily need to be defined by a representative body of members, but, once the institution decides to hold examinations, the need for definite qualifications would become equally as necessary to the foundry worker as to the sea-going engineer cited by Mr. Young.

Individual members can do much to uplift the status of the foundry in the manner suggested, but the backing of the Institution would determine an epoch in its history to which members could refer with pride as the time when the Institution decided to give an impetus to the uplifting of those employed within its sphere of influence.—Yours, etc.,

Chas. A. Otto.

22, Owenite Street, Abbey Wood, S.E.2.
October 16, 1922.

Foundry Vacancies.

In our small advertisement pages there appears an appeal by the Secretary of the Lancashire Branch of the Institution of British Foundrymen for positions for disengaged members of the Branch. The Proprietors of The Foundry Trade Journal are willing to insert similar free advertisements for other Branches.

On Saturday, the 14th inst., Mr. F. Clements, of the Park Gate Iron and Steel Company, Limited, lectured before the Rotherham Technical Institute Engineering Society on "Principles and Construction of Siemens Melting Furnaces." Mr. Edward Cross (president) occupied the chair.

Trade Talk.

THE GOLDENDALE IRON COMPANY, LIMITED, restarted one of their blast furnaces recently.

THE WORKS of Tolley, Sons & Bostock, ironfounders, of the Green, Darlaston, have been closed.

MR. W. B. PICKERING, a director of Hadfields, Limited, has been appointed Latvian Consular Agent in Sheffield.

MESSRS. H. V. CARRINGTON, tool merchants, have removed from 64, Victoria Street, S.W.1, to 28, Victoria Street, Westminster, S.W.1.

IRWIN & JONES, LIMITED, engineers, have removed from 35, Crutched Friars, to 4, Westmoreland Buildings, Aldersgate Street, London, E.C.1.

W. T. HENLEY'S TELEGRAPH WORKS COMPANY, LIMITED, have removed their Liverpool branch to larger premises at 37-41, Duke Street, Liverpool.

MR. W. J. COLES addressed the members of the Sheffield Association of Metallurgists and Metallurgical Chemists last week on the use of pulverised coal.

HOLT & COMPANY, of Liverpool, have ordered a new steamer of 7,000 tons, to be built and engined by Scotts' Shipbuilding and Engineering Company, Limited, Greenock.

EDWARD PUGH & COMPANY, Hall Green Foundry, Wednesbury, have appointed Mr. S. Haynes, 11, Forman Street, Trinity Square, Nottingham, as their agent in the East Midlands.

LUMENS, LIMITED, 11, Cathedral House, Long Millgate, Manchester, have been appointed agents in Lancashire for the Priory Electrical Engineering Company, Bath Street, Birmingham.

SIR W. G. ARMSTRONG, WHITWORTH AND COMPANY, LIMITED, of Newcastle, have secured the contract for the construction of the new floating dock at Southampton of 60,000 tons lifting power.

HALL BROS., electrical and general engineers, of Edith Walk Works, Malvern, have removed the electrical sales department of their business to 5, The Promenade, Worcester Road, Malvern.

JOHN COCHRANE (BARRHEAD), LIMITED, of Barrhead, near Glasgow, have secured the contract for the complete pumping installation for Eynsford pumping station for the Metropolitan Water Board.

MR. J. E. FLETCHER delivered a lecture on "Working Slags in Ferrous Processes" before the members of the Birmingham Metallurgical Society at the Chamber of Commerce Buildings, New Street, Birmingham.

THE WEST CUMBERLAND ASSOCIATION OF CHEMISTS, Chemical and Metallurgical Engineers, opened its second session at the Technical College, Workington, October 14, when Mr. Laigton Highton, mining engineer, read a paper on "Iron Ore."

MR. F. BIGGIN, director of the Brightside Foundry and Engineering Company, Limited, of Sheffield, has been the recipient of a presentation from the directors and staff in recognition of the forty years he has been in the service of the Company.

CENTRIFUGAL SEPARATORS, LIMITED, are extending their works at Peckham. The offices at Iddesleigh House will be closed, and all communications should in future be addressed to 161, Queen's Road, Peckham. They will retain their office at 14, Queen Victoria Street, E.C., as hitherto.

ELECTRICAL CONDUITS, LIMITED, of Walsall, have appointed E. S. Johnson & Company, 126, Pilgrim Street, Newcastle-on-Tyne, as their Newcastle and district agents, and Mr. A. Wheatley, 11, Walker Road, Higher Blackley, Manchester, as agent for Manchester, Liverpool, and district.

A MEMORIAL TABLET was unveiled and dedicated at the works of Bayliss, Jones & Bayliss, Limited, Monmore Green Ironworks, Wolverhampton, on October 18, in memory of the fifty-five employés of the firm who gave their lives in the war. The memorial was unveiled by Captain Percy T. Bayliss, one of the directors.

OWING TO two local foundries having withdrawn their tenders for the supply of iron pipes in connection with the Newport (Monmouthshire) Corporation's new water scheme, the Water Works Committee proposes to award the entire contract to Cochrane and Company, Limited, of Middlesbrough, whose price is £101,960.

The total imports of iron ore into Canada for the 6 months ending June 30 last were 47,219 tons, as compared with 32,131 tons in the first half of 1921. The exports of ore during the same six months were 1,002 tons of iron ore and 489 tons of chromite (chromic iron), as compared with 647 and 1,721 tons respectively in the first half of 1921.

IN the forthcoming ballot on the proposals of the Shipbuilding Employers for the removal of the balance of 10s. of the war bonus paid to shipyard workers, provision is made that no reduction will be enforced where the present wage is 37s. 6d. per week. There is thus an assured minimum, and wages, after the reduction has been made, will range from 42s. and more to 37s. 6d.

THE MEMBERS of the Staffordshire Iron and Steel Institute will hold their opening meeting of the session at the Education Offices, St. James' Road, Dudley, on Saturday, October 28, when the president, Mr. Jos. Payton, will give a short address, to be followed by an address by the vice-president, Mr. F. J. Cook, on his American experiences in connection with the iron and steel industries.

IT has been announced that following a meeting of the Joint Committee in connection with the hematite pig-iron industry on the West Coast, further negotiations had enabled a settlement of the dispute to be arrived at. The settlement embodies the 1919 sliding scale agreement, with a temporary supplementary arrangement, and it is to operate for governing wages up to the second full pay in July, 1923.

MR. G. W. NETTLESHIP, managing director of Blair & Company, Limited, Stockton, has resigned his position, and Mr. H. P. Hamilton, the general manager, has taken control, whilst retaining his present post. Mr. L. Parsons has been appointed secretary of the company. Mr. Nettleship, who has been with the company for 36 years, remains at the works by request of the board of management until the end of the year.

The production of pig-iron in Canada during August amounted to 27,123 tons, a decrease of 4,582 tons as compared with the output of July, chiefly attributable to the fuel scarcity. Steel production declined to 59,201 tons in August, as compared with an output of 62,767 tons in July. The August output was 17.8 per cent. less than that for August, 1921, which amounted to 72,023 tons. The cumulative production for the first eight months of this year amounts to 299,048 tons, or 29 per cent. less than that for the corresponding period of 1921.

The total production of steel ingots and castings during the six months ending June amounted to 177,080 tons, of which 169,286 tons were produced for the use in further processes of manufacturing by the makers; the balance, or 7,794 tons, was made for sale. By far the greater amount of the steel made was produced by the basic open-hearth process, the total for this item amounting to 170,182 tons, of which 167,612 tons was in the form of steel ingots and was used by the makers, and the balance, or 3,570 tons, in castings. Of this latter amount, 2,653 tons was made for sale, and 917 tons for the use of the producers. Steel for twenty tons of ingots and 800 tons of castings was made by the Bessemer process. Electric steel production amounted to 4,988 tons, of which 4,861 tons was produced as castings, and 127 tons was in the form of ingots.

THE BRASSFOUNDERS' EMPLOYERS' ASSOCIATION and the National Brass and Metal Mechanics' Society have arrived at an agreement on the question of a reduction in the war bonus. The employers' original proposal was for a reduction of 16s. a week, to become operative on October 1 last. As the result of negotiations between the parties it was eventually agreed that the "cut" should be 7s. 10d. per week. The agreement arrived at states that the reduction is to operate until the cost of living reaches 51 points over pre-war level. The agreed bonus will therefore be 17s. 7½d. It is also agreed that when the cost of living has reached the level of 51 points the present scheme of the sliding scale shall become operative, and the first further alteration shall be made. The bonus of youths of 18 and 21 years is to be reduced by the amount of 3s. 11d., bringing the total bonus to 9s. 4d. The agreement is subject to notice of three months from either party.

Beginning with January, 1921, a monthly record of the production of pig-iron and ferro-alloys in Canada has been obtained by the Bureau. Blast furnaces were operated during the period by the Algoma Steel Corporation, at Steelton, near Sault Ste. Marie, Ont.; the Dominion Iron and Steel Company at Sydney, N.S.; the Steel Company of Canada at Hamilton, Ont. At the end of June, four furnaces were in blast, two at Sault Ste. Marie, one at Hamilton, and one at Sydney. The average monthly output of pig-iron of all grades for the six months' period was 32,031 tons, of 2,240 lbs. The total for the period was 192,187 tons, as compared with 309,208 tons in the same period of 1921. Of the pig-iron made in 1922, 107,407 tons was produced by firms for their own use, and 84,684 tons was produced for direct sale. A total of 96 tons of electrically-smelted iron made during the period was all for sale. An analysis of the pig-iron output for the six months ending June shows that 56 per cent. of the total was basic iron; 34 per cent. foundry iron, and 10 per cent. malleable iron. Coke was the only fuel used in the manufacture of pig-iron in Canada during the period. The production of ferro-alloys, including the several grades of ferro-silicon, and also spiegeleisen, amounted to 9,671 tons during the half-year.

Company News.

H. I. Baker, Limited.—Capital £1,000 in £1 shares. Engineers. Directors: H. I. Baker and A. E. Garrod.

E. F. Haynes, Limited.—Capital £2,500 in £1 shares. Die sinkers. Directors: E. F. Haynes, F. J. Haynes, P. Farnell and W. E. Alldritt.

Ashton Vale Iron Company, Limited.—No allowance for depreciation; loss, £1,882; debenture interest, £364; brought forward, £594; net debit balance, £1,652.

Allen Everitt & Sons, Limited.—Interim dividends: Preference shares, 6 per cent. per annum, less tax; ordinary shares, 7½ per cent. per annum, free of tax.

Sir W. G. Armstrong, Whitworth & Company, Limited.—Profit for 1921, £438,888; brought forward, £921,329; ordinary dividend for year, 1s. per share, or 5 per cent.; carried forward, £832,092.

I. P. M. Syndicate, Limited, 82, Victoria Street, Westminster, London, S.W.—Capital £15,000 in 12,000 10 per cent. cumulative preference shares of £1 and 60,000 deferred shares of 1s. Mechanical engineers.

Eclipse Engineering Company, Limited, Eclipse Engineering Works, Manchester Road, Westhoughton.—Capital £600. Directors: S. Ogden, H. O. Dixon, F. Ratcliffe, W. Harrison, C. C. Abbott and J. Horrocks.

Charles Bell, Limited, Iron Works, Bath Street, Leeds.—Capital £15,000 in £1 shares (7,500 5 per cent. cumulative preference and 7,500 ordinary). Mechanical and electrical engineers. Directors: Lazarus Bell, Leonard Bell, and H. H. Cassé.

James Y. Millar & Company, Limited, 62, Robertson Street, Glasgow.—Capital £5,000 in 1,500 cumulative preference shares of £1 and 7,000 ordinary shares of 10s. each. Iron, steel and metal merchants. Directors: J. Y. Millar and R. H. Dempster.

Burne-Jones & Company, Limited, Montford Place, Kennington Road, London, S.E.—Capital £3,000. Consulting, mechanical and construction engineers, etc. Directors: D. Burne-Jones (managing director), F. W. Ward, J.P. and F. Foulger (all permanent).

Vulcan Foundry, Limited.—Profit, £250,611; rent of houses, £1,992; interest and discount, £2,483; registration fees, £64; total, £225,151; directors' fees, £5,209; depreciation, £44,166; reserve for trade taxation, £20,000; brought forward, £188,684; interest received, £13,386; available, £387,845; transferred to capital account in respect of bonus shares issued, £76,827; balance of income-tax, £22,173; ordinary dividend, 15 per cent. for year.

Contracts Open.

Bangkok, Siam, January 31.—Supply of railway store materials, for the Department of State Railways. C. P. Sandberg, 40, Grosvenor Gardens, London, S.W.1. (Fee, £2 12s.)

Leeds, November 10.—Supply of iron castings to the electricity department during six or twelve months, commencing January 1, 1923, for the Corporation, 1, Whitehall Road, Leeds.

Llanbedr, October 27.—For providing and laying about 3,000 lineal yards of 3-in. cast-iron pipes, for the Dolgelley Rural District Council. Mr. R. Foulkes-Jones, clerk, Bank Chambers, Llwyngwril, S.O., or Mr. F. J. Rodwell (Spinks, Pilling & Rodwell), 37 and 38, Prudential Buildings, Park Row, Leeds. (Fee £1, returnable.)

Scunthorpe, October 31.—Supply, delivery and jointing of about 600 ft. of 20-in. cast-iron gas mains and specials, for the new gasworks, for the Scunthorpe and Frodingham Urban District Council. Mr. J. F. Simpson, engineer and manager, Gasworks, Scunthorpe.

Wallingford, October 28.—Supply and fixing of four "luted" purifier covers for 12-ft. square boxes. Also an alternative tender for "luteless" covers for the same boxes. The Manager, Gasworks, Wallingford, Berks.

London, S.W., October 27-31-November 3.—The High Commissioner for India is prepared to receive tenders for supply of (1) copper plates for locomotive fireboxes; (2) boiler tubes, brass; (3) pillar water cranes; (4) steel tyres for engines and tenders; (5) electric jib crane and electric overhead crane; (6) buffers; (7) boiler tubes, solid drawn steel; (8) mild steel sheets, galvanised, corrugated. The Director-General, India Store Department, Branch No. 12, Belvedere Road, Lambeth, S.E.1. Tenders by October 27 for Nos. 1 to 3; October 31 for No. 4; and November 3 for Nos. 5 to 8.

THE LATE MR. J. SKINNER, metal merchant, of West Lynn, Norfolk, left £7,593.

Gazette.

A RECEIVING ORDER has been issued against Messrs. W. H. B. Troman & Company, 34, Rooth Street, Wednesbury, metal merchants.

MESSRS. H. BUFTON, W. MARPLES, AND C. MARPLES, electrical engineers, Fornham Street, Sheffield, trading under the style of Lee & Bufton, have dissolved partnership.

MESSRS. C. H. FISHER and C. LAW, consulting engineers and agents, 20, Westminster Palace Gardens, Westminster, S.W., trading under the style of Fisher and Law, have dissolved partnership.

TRADING in the style of J. Lyon & Company, Messrs. F. Lyon and R. Lunt, 90, Cranmer Street, Liverpool, iron, steel and nail merchants, have dissolved partnership. Debts by F. Lyon, who continues the business.

MESSRS. J. GARBETT, J. W. SHEPHERD, A. R. FRIER and A. H. DUFFIELD, ironfounders, 75, New Street, West Bromwich, trading under the style of the New Malleable Foundry Company, have dissolved partnership.

THE PARTNERSHIP HERETOFORE subsisting between Messrs. T. W. Craig and E. H. Wells, electrical engineers, 3, Church Road, Waterloo, Lancaster, under the style of T. W. Craig & Company, has been dissolved.

MESSRS. W. JORDAN AND J. CHARLESWORTH, oxy-acetylene welders and general engineers, 3, Deacon Street, Leicester, trading under the style of the Oxy-Acetylene Welding and Engineering Company, have dissolved partnership.

MR. A. H. STANDLEY, Roebuck Lane, West Bromwich, scrap metal merchant, has been adjudicated bankrupt. First meeting, O.R.'s, Birmingham, October 30, at 11. Exam., Law Courts, West Bromwick, November 17, at 11. Adj., October 12.

A PETITION for the winding-up of Sheffield Steel Products, Limited, has been presented by Hemmings & Company, Limited (in liquidation), of Paradise Street, Sheffield, creditors of the Company. The petition will be heard in London on October 31.

TRADING in the style of the Midland Brassfounders, Messrs. J. O. Widdop, C. Marshall, and W. Holmes, Falcon Works, 33, Sherwood Rise, Nottingham, brassfounders and finishers, have dissolved partnership. Debts by Messrs. C. Marshall and W. Holmes, who continue the business.

THE PARTNERSHIP HERETOFORE carried on by Messrs. H. O'Brien and H. W. O'Brien, iron founders, iron merchants and dealers, at 17, Upper Thames Street, London, E.C., and the Effingham Works, Rotherham, under the style of O'Brien, Thomas & Company, Yates, Haywood & Company, and Skelton, Corbitt & Company, has been dissolved. In future the business will be continued by H. O'Brien, H. W. O'Brien, T. O'Brien, E. H. Howard, and A. P. Harrop.

IN THE COMPANIES (WINDING-UP) COURT last week, Mr. Justice Lawrence heard a petition by Plenty & Son, Limited, creditors against the Rennie, Ritchie and Newport Shipbuilding Company, Limited, for a supervision order, the appointment of another liquidator to act with Mr. F. Whinney, the present liquidator, and the appointment of a committee of inspection. His Lordship made a supervision order and appointed a committee of inspection.

Deaths.

MR. J. CLUCAS, manager of Gelling's Foundry, Limited, South Quay, Douglas, Isle of Man, died on October 1.

MR. THOMAS B. HOSKING, of John Hosking & Sons, iron and metal merchants, 10, Albert Embankment, London, S.E.1., died on October 3, aged 77.

MR. A. S. HOLDSWORTH, managing director and secretary of H. S. Holdsworth, Limited, coppersmiths, brass finishers, etc., of Halifax, died recently in his 57th year.

MR. R. HARTLEY, at one time senior partner of R. Hartley & Sons, metal merchants, Long Brackland, Bury St. Edmunds, died recently at the age of 74 years.

MR. DAVID WILLIAM RENNIE, of the firm of John T. Rennie, Son & Company, died at Sidmouth, South Devon, last week. The fifth son of Mr. John T. Rennie, of Aberdeen, the founder of the firm that bears his name, Mr. David Rennie, who was 56 years old, had been with the firm since boyhood, and was a partner for thirty years.

MR. CHARLES CURRY SWINBURNE, J.P., head of the Wallsend firm of M. W. Swinburne & Sons, Limited, brassfounders, engineers and coppersmiths, has died as the result of an accident. Mr. Swinburne, who was 50 years of age, was a son of the late Councillor M. W. Swinburne, a former Mayor of Wallsend, who died during his year of office. He was a Justice of the Peace for Wallsend.

XUM

IRON AND STEEL MARKETS.

Pig-iron.

The outlook in the pig-iron industry, though somewhat more promising than recent reports would appear to indicate, continues indefinite, and is apparently largely dependent upon an early expansion of home consumption which is unfortunately slow in materialising. Meanwhile, it is satisfactory to record that the heavy stocks in makers' yards a short time ago have been almost entirely absorbed by the recent American demand, which although on a diminishing scale, is confidently expected to continue over the end of the current year. The Continent, also, has lately been buying in substantial volume, but in the majority of cases British makers are unable to give such early delivery as foreign producers, as notwithstanding the increased output at home furnaces, the bulk is absorbed in filling contracts already entered into with America. A hopeful feature of the pig-iron market is the improved demand that has sprung up of late from the home foundries. In the Midlands, the markets for pig continue unsatisfactory, due to the slackness of the home demand, as trade in these districts has been practically unaffected by the recent boom in exports. Prices, however, are firmly maintained, and business is almost entirely confined to hand-to-mouth deliveries, mostly of Derbyshire and Northamptonshire makes. South Staffordshire furnaces remaining in the majority of plants unproductive. Scottish makers are still busy completing American contracts in hand, which for the present afford an outlet for their furnace outputs, but with the cessation of the export demand will find some difficulty in keeping plants fully employed. At Teesside, notwithstanding the heavy shipments which have been made this month to America, makers have still sufficient orders in hand to keep them busy for some time to come, and a moderate business is being negotiated for further supplies both of foundry iron to special analysis and of the standard No. 3. A certain amount of basic iron is also being bought. Producers look for a temporary continuance of this business, for costs of production in the U.S.A. continue to be very high, while apart from that it will take time to make up the existing shortage. The home trade is slowly improving. Consumers who have been recently buying on a restricted scale now see that there is little prospect of any early easing in prices, and are covering their requirements till the end of the year. The export trade with the Continent is quiet. Buyers abroad cannot apparently afford to pay the price now being demanded, especially in view of the acute difficulties created by the exchange position. Meanwhile, quotations are very firmly held at last week's levels, as follows:—No. 1 and silicious, 97s. 6d.; No. 3 G.M.B., 92s. 6d.; No. 4 foundry, 90s.; No. 4 forge, 85s.

In regard to hematite pig-iron the recent sharp American demand has effected a complete change in the position. Makers having practically cleared out their stocks, which had looked like being a heavy drag over the winter, are now comfortably placed. On the whole, apart from the influence of rising fuel costs, there is a tendency for prices to stiffen, and at last week's market 92s. 6d. was generally the minimum figure for East Coast mixed numbers, with 6d. to 1s. extra for the No. 1 quality. West Coast hematite prices are unchanged, Bessemer mixed numbers being quoted at 100s. per ton delivered at Glasgow and Sheffield, and for export at 102s. 6d. to 105s. per ton.

Finished Iron.

There is very little, if anything, of interest to note in the conditions of the markets for finished material, the continued inactivity of the consuming industries retarding any expansion of demand at home, while an increased export trade is rendered difficult by the violent fluctuations in the foreign exchanges. At Birmingham last week the volume of business passing in this section was again disappointing, and from a prices point of view, conditions were rather worse than they have been. Makers of marked bars are, however, still comparatively steadily employed, although forward business to any extent is hard to obtain, and the orders in hand are barely sufficient to keep mills working for anything like full time. The list houses still maintain quotations on the basis of £13 10s. for marked bars, owing to the continued high cost of production, while crown qualities can be bought round about £10 15s., whereas the actual cost of manufacture is stated to be upwards of £11. Gas strip, also at £10 15s., is not covering costs, and the South Staffordshire firm who recently restarted their works after having had them idle for well over a year are contemplating closing them again. The inquiry for nut and bolt iron has decreased, and the price has fallen to £9 15s. Special irons continue to feel the pressure of steel competition. The much lower price at which the latter can be obtained is severely restricting the demand for cable and such irons.

Scrap.

Business in most sections of the scrap-metal trade remains without any marked improvement, with, perhaps, an exception in the case of heavy steel material, in which some gradual expansion of demand may be noted. Dealings, however, in this quality of scrap are limited to unimportant quantities, but demand is certainly more active, and with supplies of the right kind rather on the scarce side prices in the Cleveland market are advancing. Last week 67s. 6d. per ton was paid, as against 65s. previously quoted. Heavy steel turnings were also a good market, with the price firm at 53s. 6d., while cast-iron borings were realising 52s. 6d. There is now a little quiet buying in heavy cast-iron machinery scrap in handy pieces, for which 75s. to 77s. 6d. is named, ordinary descriptions offering at 70s. to 72s. 6d. Heavy wrought iron is still idle, the nominal prices being 55s. to 57s. 6d. for bushelling, 60s. for ordinary heavy piling, and 70s. to 75s. for specially selected heavy forge. All quotations are delivered works.

Steel.

A steady, if gradual, improvement may again be reported in steel-trade conditions, and although many plants in the chief manufacturing centres are still only partially employed, the outlook may be confidently regarded as more favourable than for a long time past. More especially does this tendency apply in the markets for Welsh semi-products, in which determined efforts are in evidence to exclude foreign bars by the assistance makers are giving to the tinplate makers for the purpose of maintaining a minimum basis price. As has been repeatedly pointed out of late, the Welsh makers were badly in need of specifications, and unless a change came over the market some of the works would have to shut down. While Welsh producers have found it necessary to maintain the price of sheet and tinplate bars at £7 7s. 6d., the Continental makers have been cutting in at under £6 15s. delivered, and have naturally monopolised any business offering, particularly as their delivery has not been unduly delayed. The Lincolnshire and other makers have also been underquoting the Welsh, with the result that the latter have now arranged to supply the tinplate makers at £7, providing the tinplate mills maintain a minimum of 19s. 3d. per standard box. In the Sheffield steel market prices are firm for both acid and basic billets, though buying is only moderate. In all the cheaper steels there is quite active business, and the exports of these are now in considerable volume. For the costly special steels there is very little demand, and practically none of it is leaving the country owing to the high prices asked. At some of the rod and strip mills almost full time is being worked at present, an encouraging sign of revival. Some orders in connection with shipbuilding work have come to the aid of the casting and forging departments of a few of the local works. The demand for ferro-alloys is fair on home account, and for export several inquiries are in circulation. It is impossible to quote American ferro-manganese, as the makers have not yet announced prices. Ferro-silicon has shed a few more shillings in both 45 per cent. and 75 per cent. grades, and one or two nice orders have been placed at just over £11 per ton, delivered, for 45 per cent. High-carbon ferro-chromes are in moderate request, with prices fairly steady, and a slight tendency to harden in the 4/6 per cent. grade. More interest is evinced in the refined grades, a considerable amount of which is destined for manufacturing into stainless steel, for which a better demand is apparent. The tone of the tinplate market is steady, though the business going through is not large, but there is a better feeling about, and as the makers are about to take combined action to regulate output in accordance with demand, several buyers consider the present a good time to cover their requirements. 19s. has been freely paid for the standard sizes, but 3d. extra is now required. Current quotations for coke finish are firm, as follows:—IC 14 x 20, 112 sheets, 108 lbs., 19s. 3d. per box; IC 28 x 20, 112 sheets, 216 lbs., 38s. 6d. per box; light and crosses at usual differences, net cash, f.o.b. Wales

Metals.

Copper.—Business in the standard market for this metal during the past week has been somewhat irregular, values fluctuating from day to day, while home consumptive demand has been by no means active. Smelter output in the United States in September is estimated at about 85,000,000 pounds. Stocks of blister copper having been almost exhausted, the September production of refined copper is estimated at 130,000,000 pounds, being about 30,000,000 pounds less than combined deliveries into domestic and foreign consumption, thus indicating a decrease of about 30,000,000 pounds in stock, which on October 1 stood at 270,000,000 pounds. Deliveries into domestic consumption are estimated at 100,000,000 pounds. Current quotations :—*Cash* : Wednesday, £62 5s. ; Thursday, £62; Friday, £61 17s. 6d. ; Monday, £62 10s. ; Tuesday, £63. *Three months* : Wednesday, £62 15s. ; Thursday, £62 15s. ; Friday, £62 12s. 6d. ; Monday, £63 5s. ; Tuesday, £63 12s. 6d.

Tin.—Interest in the metal markets of the week has again been centred on the continued buoyancy of the tin section in which the business transacted has been on a scale of exceptional magnitude, with values daily progressing in an upward direction. So far this month tin has appreciated £8 7s. 6d. for cash delivery. New records for the year have been realised at £172 7s. 6d. and £35 15s. respectively. At last week's close tin values wavered somewhat. Some fluctuations are expected, although there is reason for believing that the upward movement will eventually proceed further. Consumption is more than sufficient to absorb current production. Current quotations :—*Cash* : Wednesday, £171 ; Thursday, £172 5s. ; Friday, £171 15s. ; Monday, £173 5s. ; Tuesday, £174 7s. 6d. *Three months* : Wednesday, £171 15s. ; Thursday, £173 5s. ; Friday, £172 15s. ; Monday, £174 2s. 6d. ; Tuesday, £175 2s. 6d.

Spelter.—Quotations for spelter continue on the upgrade, and have now reached levels much above the intrinsic value of the metal. Consistent reports are circulated with regard to the scarcity of supplies, but although, undoubtedly, there are no particularly large quantities of spelter available, too much has been made of this restriction, and prices now current by no means reflect the true position of the metal. However, the quantity of concentrates arriving is steadily increasing, and the position shortly should be somewhat alleviated. Current quotations :—*Ordinary* : Wednesday, £34 10s. ; Thursday, £35 2s. 6d. ; Friday, £33 2s. 6d. ; Monday, £35 17s. 6d. ; Tuesday, £36 2s. 6d.

Lead.—A feature in the market for soft foreign pig of late has been the increased turnover in lead, but it is to be feared that a lot of the business done has been on speculative account. The amount of genuine business doing for consumers is very small, and while the stocks in the United Kingdom are stated to be only 583 tons, everybody connected with the trade is fully aware of the fact that this does not represent the exact position, there being lead in other warehouses. Current quotations :—*Soft foreign (prompt)* : Wednesday, £25 7s. 6d. ; Thursday, £25 2s. 6d. ; Friday, £25 7s. 6d. ; Monday, £25 7s. 6d. ; Tuesday, £26 10s.

Production Engineers' Gathering.

Members of the Institution of Production Engineers and their friends spent an interesting evening at the Royal Automobile Club on Friday last, on the occasion of the opening meeting of the session. This newest of engineering associations has been largely brought about by the intensive manufacturing conditions that prevail in the engineering world to-day. It exists primarily with the object of bringing manufacturing engineers into touch with one another, with a view to an interchange of ideas in the latest works practice. After the reception a short Presidential Address was delivered.

Foundry Cupolas,

In Mr. E. A. Roper's article an unfortunate mis-print crept in. Under the heading of "Tuyeres," on page 322, the second paragraph instead of "This would be most marked in a large cupola with a large charging hole," read "This would be most marked in a large cupola with a low charging hole."

Telephone: 21, Penistone. Telegrams: "Durranns, Penistone."

ESTABLISHED 1863.

JAS. DURRANS & SONS., LTD.

Phoenix Works, Penistone NEAR SHEFFIELD.

BLACKING PLUMBAGO CORE GUM WHITE DUST COAL DUST

Manufacturers of

FOUNDRY EQUIPMENTS.

Ladles, Cupolas, Fire Bricks, Ganister, Stone Flux, Loam and Sand Mills, Casting Cleaners, Studs, Chaplets, Pipe Nails, Sprigs, Brushes, Wire Brushes, Core Ropes, Bellows, Buckets, Spades, Forks, Riddles, Sieves, Barrows, Etc.

Write for illustrated catalogue on Blacking and Foundry Requisites, also for our latest Price List.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	63	0	0
Three months	63	12	6
Electrolytic	70	5	0
Tough	65	5	0
Best selected	65	5	0
Sheets	96	0	0
India	84	0	0
Wire bars	70	0	0
Do. Nov.	70	0	0
Do. Dec.	70	0	0
Ingot bars	70	0	0
H.C. wire rods	74	15	0
Off. aver. cash, Sept. 63	3	4⅝	
Do. 3 mths., Sept. 63	12	5⅜	
Do. Settlement Sept. 63	2	11½	
Do. Electro, Sept. 71	3	2¼	
Do. B.S., Sept.	67	0	0
Aver. spot price, copper, Sept.	63	2	7½
Do. Electro, Sept. 71	8	1	
Solid drawn tubes		13½d.	
Brazed tubes		13½d.	
Wire		10½d.	
Yellow metal rods		6½d.	
Do. 4x4 Squares		8½d.	
Do. 4x3 Sheets		9½d	

BRASS.

Solid drawn tubes	11½d.
Brazed tubes	13½d
Rods, drawn	10½d.
Rods, extruded or rolled	6½d.
Sheets to 10 w.g.	10d.
Wire	9½d.
Rolled metal	9½d.

TIN.

	£	s.	d.
Standard cash	174	7	6
Three Months	175	2	6
English	174	5	0
Bars	176	5	0
Chinese	173	10	0
Straits	175	12	6
Australian	175	15	0
Eastern	176	10	0
Banca	174	12	6
Off. aver., cash, Sept.	160	2	8¼
Do. 3 mths., Sept.	160	0	7½
Do. Sttlment. Sept.	160	2	3½
Aver. spot, Sept.	160	1	3½

SPELTER.

	£	s.	d.
Ordinary	36	2	6
Remelted	33	0	0
Hard	26	10	0
Electro 99.9	38	10	0
English	36	0	0
India	27	10	0
Prime Western	36	0	0
Zinc dust	48	0	0
Zinc ashes	11	0	0
Off. aver., Sept.	31	8	8⅝
Aver., spot, Sept.	31	14	10½

LEAD.

	£	s.	d.
Soft foreign ppt	26	10	0
English	27	10	0
Off. average, Sept.	23	16	3⅝
Average spot, Sept.	24	2	9

ZINC SHEETS.

	£	s.	d.
Zinc sheets, English	40	0	0
Do. V.M. ex. whf.	40	5	0
Dutch	40	0	0
Rods	45	10	0
Boiler plates	38	10	0
Battery plates	39	0	0

ANTIMONY.

	£	s.	d.
English regulus	27	0	0
Special brands	33	10	0
Chinese	25	10	0
Crude	18	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	11	12	6

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
45/50%	11	2	6
75%	19	10	0
Ferro-vanadium— 35/40%	17/- lb. va.		
Ferro-molybdenum— 70/75%	8/9 lb. mo.		
Ferro-titanium— 23/25%, carbonless	1/2 lb.		
Ferro-phosphorus, 20/23%,	£24		
Ferro-tungsten— 80/85%, carbon free	1/5 lb.		
Tungsten metal powder— 98/99%	1/11 lb.		
Ferro-chrome—			
4/6% car.	£23	5	
6/8% car.	£22	15	
8/10% car.	£22	10	
Ferro-chrome—			
Max. 2% car.	£55		
Max. 1% car.	£68		
Max. 0.70% car.	£75		
67/70%, carbonless	1/6½ lb.		
Nickel—99%, cubes or pellets	£140		
Cobalt metal—98/99%	12/- lb.		
Aluminium—98/99%	£95		
Metallic Chromium— 96/98%	4/9 lb.		
Ferro-manganese (net)—			
76/80%, loose	£15		
76/80%, packed	£16		
76/80%, export	£14	10	
Metallic manganese— 94/96%, carbonless	2/3 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

	s.	d.
Finished bars, 14% tungsten	2	6
Finished bars, 18% tungsten	3	0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares 3 in. to 8 in. inclusive	4d. lb.
Rounds and squares under ½ in. to ¼ in.	3d. lb.
Flats under 1 in. by ½ in. to ¼ in. by ¼ in., and all sizes over four times in width over thickness	3d. lb.
Bevels of approved sizes and sections	6d. lb.
If in coils	3d. lb.
Packing	£3 ton.
Bars cut to length 10% extra	

Scrap from high-speed tool steel—

Scrap pieces	3d.
Turnings and swarf	1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£	s.	d.
South Wales—Heavy Steel	3	10	0
Bundled steel & shearings	2	19	0
Mixed iron & steel	3	17	0
Heavy cast iron	3	10	0
Good machinery for foundries	4	0	0
Cleveland—			
Heavy steel	3	7	6
Steel turnings	2	13	6
Cast-iron borings	2	12	6
Heavy forge	3	12	6
Bushelled scrap	2	16	3
Cast-iron scrap	3	11	3
Lancashire—			
Cast iron scrap	3	17	6
Heavy wrought	3	7	6
Steel turnings	2	2	6
London—			
Copper (clean)	36	0	0
Brass (clean)	32	0	0
Lead (less usual draft)	21	10	0
Tea lead	19	0	0
Zinc	20	0	0
New aluminium cuttings	60	0	0
Braziery copper	46	0	0
Gun metal	40	0	0
Hollow pewter	125	0	0
Shaped black pewter	80	0	0

Above are merchant's buying prices delivered yard.

PIG-IRON.

N. E. Coast—	
Foundry No. 1	97/6
Foundry No. 3	92/6
Forge No. 4	85/-
Mottled	80/-
Hematite No. 1	93/9
Hematite M/Nos.	92/6
Midlands—	
Staffs. common	—
„ part-mine forge	—
„ „ foundry	—
„ Cold blast	240/-
„ basic	—
Northants forge	70/- to 72/6
„ foundry No. 3	77/6 „ 80/-
„ basic	80/-
Derbyshire forge	75/-
„ foundry No. 3	82/6
„ basic	80/-
Scotland—	
Foundry No. 1	105/-
„ No. 3	100/-
Hematite M/Nos.	107/6
Sheffield (d/d district)—	
Derby forge	82/6
„ foundry No. 3	86/6
„ basic	—
Lincs. forge	86/6
„ foundry No. 3	87/6
„ basic	86/6
E.C. hematite	102/-
W.C. hematite	102/6

All d/d in the district.

Lancashire (d/d eq. Man.) —	
Derby forge	—
„ foundry No. 3	90/-
Northants foundry No. 3	—
Cleveland foundry No. 3	—
Staffs. foundry No. 3	—
Lincs. forge	—
„ foundry No. 3	—
Summerlee foundry	116/6
Glengarnock foundry	118/6
Gartsherrie foundry	118/6
Monkland foundry	116/6

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.
Bars (cr.)	£10 10 to 11	10	0
Angles	£10 15 to 11	15	0
Tees to 3 united ins.	£11 to £12		
Nut and bolt	9	15	0
Hoops	14	0	0
Marked bars (Staffs.)	13	10	0
Gas strip	10	15	0
Bolts and nuts, ½ in. × 4 in.	17	10	0
Steel—			
Ship plates	£9 to 9	10	0
Boiler plates	12	10	0
Chequer plates	10	5	0
Angles	£8 12 6 to 9	0	0
Tee	£9 12 6 to 10	0	0
Channels	8	10	0
Joists	9	0	0
Rounds & squares 3-in. to 5½in.	9	15	0
Rounds, under 3in. to ½in.	8	15	0
Flats, over 5in. wide and up	9	15	0
Flats 5in. to 1½in.	8	5	0
Rails, heavy	8	15	0
Fishplates	14	10	0
Hoops	£11 0 0 to 11	10	0
Black sheets, 24 g.	12	0	0
Galv. cor. sheets, 24 g.	16	5	0
Galv. fencing wire, 8 g. plain	16	0	0
Rivets, ½ in. dia	12	15	0
Billets, soft	7 0 0 to 7	2	6
Billets, hard	8	0	0
Sheet bars	6 17 6 to 7	7	6

PHOSPHOR BRONZE.

	Per lb basis	
Strip	1	3
Sheet	1	3½
Wire	1	3½
Rods	1	2½
Tubes	1	6
Castings	1	1

Delivery 3 cwt. free to any town.

10% phosphor copper, £40 above price of B.S.

15% phosphor copper, £50 above price of B.S.

Phosphor tin (5%), £30 above price of English ingots.

Charles Clifford & Son Limited, Birmingham.

NICKEL SILVER, SHEET METAL, WIRE AND TUBES.

	Per lb.
Ingots for raising	11d. to 1/5
Rolled—	
To 9 in. wide	1/5 to 1/11
To 12 in. wide	1/5½ to 1/11½
To 15 in. wide	1/6 to 2/0
To 18 in. wide	1/6½ to 2/0½
To 21 in. wide	1/7½ to 2/1½
To 25 in. wide	1/8½ to 2/2½
Ingots for spoons and forks	11d. to 1/5
Ingots rolled to spoon size	1/2 to 1/8
Wire round— 3/0 to 10. G.	1/8½ to 2/3½

with extras according to gauge

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	33.14
No. 2 foundry Valley	32.50
No. 2 foundry, Birm.	27.50
Basic	32.96
Bessemer	35.27
Malleable	32.00
Grey forge	33.77
Ferro-manganese 80 % delivered	75.00
Bess. rails, h'y, at mill	43 00
O.-h. rails, h'y, at mill	43.00
Bess. billets	40.00
O.-h. billets	40.00
O.-h. sheet bars	40.00
Wire rods	45.00
	Cents.
Iron bars, Phila.	2.47
Steel bars	2.00
Tank plates	2.15
Beams, etc.	2.00
Skelp, grooved steel	2.00
Skelp, sheared steel	2.00
Steel hoops	2.90
Sheets, black, No. 28	3.50
Sheets, galv., No. 28	4.50
Sheets, blue an'l'd, 9&10	2.60
Wire nails	2.70
Plain wire	2.45
Barbed wire, galv.	3.35
Tinplate, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	35/- to 37/6
„ furnace	26/- to 27/6
Durham & North. foundry	30/-
„ furnace	27/-
Other Districts, foundry	30/-
„ furnace	26/-

SWEDISH IRON.

Bars, hammered basis sizes Basis price £22 to £23

	£ s. d.
Rolled Ordinary— Assortment ..	17 10 0 to
Nail Rods— Square, round and flats ..	18 0 0

Keg Steel nom. £38 to £40
Faggot Steel nom. £30 to £32

Blooms—
Single welded .. £10 to £11

Billets—
Single and double welded £13 to £14

Pig-Iron—
Grey, white or mottled .. £7 to £7 10 0

Prices are without engagement. All quotations are f.o.b. Gothenburg, net cash against documents there.

TUBES.

	Up to and incl. 6 in.	
Gas ..	55%	Tube prices are now free.
Water ..	50%	
Steam ..	45%	

TINPLATES.

I.C.Cokes,	20×14, box	19/3
„	28×20, „	38/6
„	20×10, „	28/3
„	18¾×14, „	19/3
I.X.	„	45/-
I.X.X.	„	51/-
F.C.B.Y.	21×13½ „	36/6
C.V.B.G.	16¾×15, „	35/-
I.C.W.	20×14, „	16/10½
„	28×20, „	33/3
„	20×10, „	23/3
„	18¾×14, „	17/1½
Terneplates,	28×20, „	35/9

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.		
Oct. 18	62	5	0	dec.	5/-
„ 19	62	0	0	„	5/-
„ 20	61	17	6	„	2/6
„ 23	62	10	0	inc.	12/6
„ 24	63	0	0	„	10/-

Electrolytic Copper.

Oct. 18	70	10	0	dec.	10/-
„ 19	70	0	0	„	10/-
„ 20	70	0	0	No change	
„ 23	70	5	0	inc.	5/-
„ 24	70	5	0	No change	

Standard Tin (cash).

Oct. 18	171	0	0	inc.	32/6
„ 19	172	5	0	„	25/-
„ 20	171	15	0	dec.	10/-
„ 23	173	5	0	inc.	30/-
„ 24	174	7	6	„	22/6

Tin (English ingots)

Oct. 18	170	10	0	inc.	30/-
„ 19	171	10	0	inc.	20/6
„ 20	171	5	0	dec.	5/-
„ 23	172	15	0	inc.	30/-
„ 24	174	5	0	„	30/-

Zinc Sheets (English).

Oct. 18	39	10	0	No change	
„ 19	39	10	0	„	
„ 20	39	10	0	„	
„ 23	40	0	0	inc.	10/-
„ 24	40	0	0	No change	

Spelter (ordinary).

Oct. 18	34	10	0	inc.	5/-
„ 19	35	7	6	„	17/6
„ 20	36	0	0	„	12/6
„ 23	35	17	6	dec.	2/6
„ 24	36	2	6	inc.	5/-

Lead (English).

Oct. 18	26	10	0	dec.	5/-
„ 19	26	5	0	„	5/-
„ 20	26	5	0	No change	
„ 23	26	10	0	inc.	5/-
„ 24	27	10	0	„	20/-

THE
ARMITAGE WORKS Co., Ltd.
Manufacturers of
Highly Refractory Bricks and Blocks
FOR ALL PURPOSES.

SPECIALITIES:
CUPOLA LININGS.
Ladle Bricks for Siemens Ladles.
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GROUND GANISTER
for Iron, Steel, and Brass Furnaces. Forced Draught Brass Furnaces. Semi-Silica or Semi-Ganister Bricks. Silica Cement.

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Telegrams:—
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Sunbrand (Cannon), London.

Telephone:—
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5959 Central.

BARS, HOOPS, SECTIONS & WIRE
in IRON, STEEL, COPPER and BRONZE.
Galvanised Telegraph, Telephone, Cable and Trolley Wire
To all Specifications.

Contractors to H.M. Government (Admiralty, G.P.O., India Office, War Office, Colonies), English and Foreign Railways, &c.

BEST H. C. COPPER & BRONZE WIRE a speciality.

Medals:—Sydney (Bronze) 1879, New Zealand (Gold) 1882, Liverpool (Silver) 1886, Adelaide (Gold) 1887, Franco-British Grand Prix (Highest Award) 1908.

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EXCHANGE BLDGS., PORT TALBOT
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1, HONG KONG ROAD, SHANGHAI
31, RAFFLES PLACE, SINGAPORE.
JAVA STREET, KUALA LUMPUR.
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COX'S BUILDINGS, KARACHI.

PIG IRON
SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.
IRON & STEEL SCRAP
COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM COLVIN & COMPANY,
ROYAL EXCHANGE, MIDDLESBROUGH.
93, HOPE STREET, GLASGOW.

SITUATIONS VACANT AND WANTED.

THE Lancashire Branch of the Institution of British Foundrymen beg to announce that several members, who have had varied experience as Foremen, etc., are at present disengaged. Employers who are in need of Foremen or other members of their foundry staff are invited to communicate with the Honorary Secretary, T. Makemson, 21, Beresford Road, Stretford, Manchester.

WANTED, FIRST-CLASS MACHINE CORE MAKER. State age, wages, experience of Machines, to Box 274, Offices of the Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

WANTED.—One Foundry Foreman for heavy marine work and one for light castings and cylinders in Great Britain; McLain Graduates preferred.—State age, experience and salary first letter to McLain's System (Inc.), 710, Goldsmith Building, Milwaukee, Wis.

PROPERTIES FOR SALE.

FOR SALE by Private Treaty, MODERN IRON-FOUNDRY, FREEHOLD LAND and BUILDINGS, covering an area of 1,865 square yards, complete with all Plant, including two Cupolas, 4 ft. 3 in. and 3 ft. 9 in. dia., together with Fans, 10-ton Electric Overhead Travelling Crane, Loam Mill, Sand Mixer, Moulding Boxes, etc., within two minutes of Wakefield (Kirkgate) Goods Station. Part purchase price can remain.—For permission to view, apply Joseph Rhodes & Sons, Limited, Grove Iron Works, Wakefield.

WAGON WORKS FOR SALE as a Going Concern. The property is situate on the Great Eastern Railway within 100 miles of London. The Buildings are well adapted for the work, and are fully equipped with up-to-date Plant. The Business has been in existence for many years and showing profits. The price of £11,000 represents the value of the Land, Buildings and Plant, and nothing is asked for Goodwill. The Stock, Stores and work-in-progress could be taken over at a valuation, if desired.—Full particulars may be obtained of Fuller, Horsey, Sons & Cassell, 11, Billiter Square, London, E.C.3.

FOR SALE as a going concern, the business of Messrs. W. J. & C. T. Burgess, Engineers and Iron Founders, Victoria Works, Brentwood, Essex.

FREEHOLD LAND AND BUILDINGS: These comprise a site area of approximately 4 acres, and the Buildings include large and well-arranged Engineering and Foundry Premises, containing Machine Shops, Smiths' Shop, Foundries, Stores, Sheds, Offices, etc., together with a well-built Residence and two Cottages.

THE PREMISES, situate close to 'bus routes, are within easy access of the G.E. Rly., possessing an extensive frontage to Ongar Road of about 800 ft.

PLANT AND MACHINERY: The main Machine Shop is well equipped with about 50 Machine Tools, including Lathes, Planes, Drillers, Slotters, Grinders, etc.

FOUNDRY EQUIPMENT: This includes 2 Cupolas, 4 Pot Furnaces, and upwards of 50 tons of Foundry Boxes, etc.

SPECIALITIES AND PATENTS manufactured by this Firm include Engineers' Quick Grip Vices, Bucket Pumping Machinery, Saw Cotton Gin, Field Mower parts, Portable Hand Baling Press, and Motor Lawn Mowers, of which they possess drawings, patterns, patents, jigs, and unassembled parts. The business was established in 1849, and has been in the same family ever since.

There is also a quantity of STOCK and STORES, and well-fitted offices. Plans may be inspected and further information with order to view obtained from the Trustee, H. T. Bloor, Esq., Messrs. W. F. Smart, Son & Bloor, 255, Finsbury Pavement House, E.C.2, or Messrs. Henry Butcher & Company, Auctioneers, Valuers and Surveyors, 63 and 64, Chancery Lane, W.C.2.

To THE EDITOR of the Foundry Trade Journal.

Please send me details of the visit to the International Foundry Trade Congress and Exhibition to be held in Paris next September.

Name.....

Address.....

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MACHINERY.

FOUNDRY SAND MIXERS (three), never been used, for 1, 2 and 4 tons per hour; clearance prices.—Box 158, Offices of the Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

FOR SALE.

6-Wheel Coupled Saddle Tank Locomotive (Manning Wardles), with inside cyls., 12 in. dia. x 18 in. stroke, 4 ft. 8½ in. gauge, 140 lbs. W.P., sale or hire 5-Ton "Grafton" Loco. Steam Crane, with 35 ft. steel latticed jib, 4 ft. 8½ in. gauge, boiler 7 ft. 6 in. x 3 ft. 6 in., for about 80 lbs. W.P. 3-Ton "Grafton" ditto, with 27 ft. 6 in. steel latticed derricking jib, 4 ft. 8½ in. gauge, boiler 7 ft. 6 in. x 3 ft., for 70 lbs. W.P. Six 2-Ton Steam Transporter and Jib Cranes (Ransome & Rapier), 21 ft. max. radius, 10 ft. gauge, boiler 7 ft. 6 in. x 3 ft. 6 in., for 100 lbs. W.P. Practically new 4-Ton Hand Derrick Crane, with 40 ft. timber jib. Mortar Mills, 9 ft., 7 ft., 6 ft., and 4 ft. sizes. 4-Wheel Coupled Saddle Tank Locomotive (Hawthorn Leslies), with outside cyls., 14 in. dia. x 20 in. stroke, 4 ft. 8½ in. gauge, 140 lbs. W.P.; sale or hire.

Catalogue of Stock Machinery, 6,000 Lots.
Free on Application. Inspection Invited.

THOS. W. WARD, LTD.,
ALBION WORKS,
SHEFFIELD.

FOR SALE.—1—150-lb. Morgan's Brass Tilting Furnace, type S., coke-fired, complete, nearly new.—Box No. 280, Offices of the Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

OIL-ENGINE DRIVEN COMPRESSOR, by Blackstone, 300 lbs. pressure, 120 cubic ft. per minute, 45 h.p.; as new. 26¼ kw. New Steam Generating Set, by Browett Lindley-Laurence Scott, 110 volts. 20-h.p. 220-volt Siemens Motor and Starting Panel; as new. Two nearly new Sand Mills, 32-in. pan.—Harry H. Gardam & Company, Limited, Staines.

WANTED.—MOULDING MACHINE, preferably "Tabor" type, if possible including Compressor; must be in running condition and cheap: London area preferred.—Full details to Box No. 282, Offices of the Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

WANTED.—Good second-hand 4- or 5-ton geared Foundry Ladle.—Full particulars, including taper, thickness of plates, price, etc., to The United Steel Companies, Limited, Butlin Branch, Wellingborough.

PATENTS.

ADVICE and Handbook Free.—King's Patent Agency, Limited, Director, B. T. King, Reg. Patent Agent, 146a, Queen Victoria Street, E.C.4.

MISCELLANEOUS.

PENCIL GANISTER, of high quality, and other grades for Sale.—Apply, R. E. Adamson, Ushaw Moor, County Durham.

PATTERNS of Every Description, Large or Small. Let us quote you for sound, accurate, well-finished Pattern, or a cheap rough job. We can give you quick delivery at keen prices. Fully-electrically-equipped works; over 30 years' practical experience.—Walter Totty, Greenfoot Pattern Works, Old Town, Barnsley.

WANTED.

STEEL FOUNDRY PLANT.

TROPENAS CONVERTER, 1 to 1½ tons capacity, also a 2/3 ton Converter.
BLOWERS to suit—belt or motor driven.
CUPOLA about 4 feet diameter.
SAND BLAST room about 12 feet square or larger, with table preferred.
TURNOVER JOLT ram moulding machine of large size; also several smaller *plain jolters*, by Britannia or Jackman.
LADLES—Two 5 ton lip pouring ladles.
Two 3 " " " "
One 1 " " " "
Two 2 " " " "
Several bottom pouring ladles
Offers of other useful plant also invited.

Replies to Box No. 278, "Foundry Trade Journal," Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.